

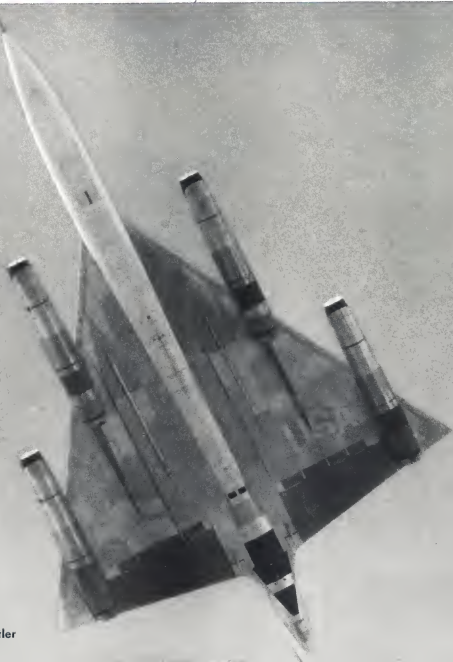
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# AVIATION WEEK

A MCGRAW-HILL  
PUBLICATION

Civil Training Saves  
Millions for USAF

•  
Wingtip Vortices  
Light Plane Hazard?



Convair's B-58 Hustler

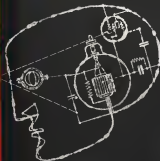


## Engineering to the Nth power...INSIDE AND OUT!

Installed inside a Convair T-29 is an actual cockpit of Convair's delta-wing F-102A all-weather interceptor. Once aloft, the "back seat" pilot flies the T-29 by performing all the functions of a F-102A interceptor pilot. At the same time, scientists and engineers evaluate system performance and a psychologist checks pilot reaction. This use of the T-29 as a flying laboratory by Hughes Aircraft Company, Culver City, California, flight tests the F-102A's advanced electronic weapon system with far more efficiency than ever before — and at a fraction of the cost.

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SLICE CABLE

ARRESTED SPRUE

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● 1997年12月1日，国务院颁布《中华人民共和国学位条例暂行实施办法》，对《学位条例》进行了修订。

All American Engineering Company

**Dec. 20-21—Hend King Design** Subcontract Model Plans, Contact: U.S. Marine Corps, Ft. Stennis, Vicksburg, Va.

**Jan. 9-9, 1987-1991 Annual Vienna Theatre Arts Circus,** sponsored by Atlantic City Photo Arts Inc. Details only James C. Pope circus director, PAPA, 330 N.W. 26 Ave., Miami Fla.

**Jan. 14-16-National Symposium on the Viability and Quality** Contact in Houston, sponsored by DRF, ASQC, AFIR and RUTSA Hotel Statler, Washington, D.C.

[illegible]

AVIATION WEEK ■ DECEMBER 12, 1994

Vol. 48, No. 2

[illegible]

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**LOOKS AHEAD**  
with  
**TWA**



Relative masses shown below are from a molecule of the dimer (20)



**ALL ABOARD** for new passengers: cruise mode turns more pleasurable by gently tilting interior paneling. Conditioned air system, hot seats, lavatories, all are designed for maximum convenience.



**NINETY-EIGHT PASSENGERS** were on board in present stock-up stage. Lounge seats can be removed for 10 more passenger seats. Kitchens and galley window shades can be pulled up for glare reduction.



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### ORDINARY AND EXTRAORDINARY SAND CASTINGS

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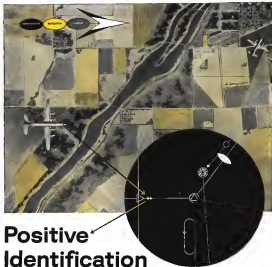
### PLASTER CASTINGS

THE SHARP TOOL CUTTING. Dow can supply you with any shape or size required. Specialized inspection techniques rapidly maintain your standards and specifications. Henry-well or flat-wall, the best—and same—answer to your problems are Dow magnesium castings! Contact your nearest Dow sales office for additional information.

THE DOW CHEMICAL COMPANY  
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Collins 621A-1 ATC Transponder of Collins Airborne Electronic System

Instantly replaces the transponder of the Air Traffic Control secondary codes, Coded ATIA is different from the codes you can hear on weather. Select one of 64 different reply codes on weather to the ground. Transmitted information will be displayed on ATC radar. The ATIA is contained in a MATX case, modified, weighs only 25 pounds. Receiver on 1030 mhz and is crystal controlled to ensure reception of interrogations. Transmitter frequency 1090 mhz, stability  $\pm 3$  mhz. Equipment will be available for use in CAA evaluation of ATC Interceptor-Transponder System.



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## BURSTING THROUGH THE SOUND BARRIER...



U.S.A.F. - CORAUX 30A

## MEANT BETTER TIRES FOR YOU!

How U. S. Rubber Engineers have met the toughest tire problems and benefited all Aviation



Every day U. S. Rubber engineers are being asked to produce military aircraft tires which, without added size or weight, must withstand ever greater amounts of heat, speed, impact, and load.

Their success in keeping pace and ahead of the needs of the military is reflected directly in the quality of U. S. Royal Tires for commercial and civilian aviation as well!

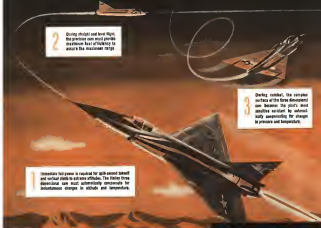
Nylon, for instance, was introduced by U. S. Rubber first through a military aircraft. Today this fabric helps strengthen U. S. Royal Tires against landing wear and tear, in a very literal fashion, off the carrier decks and military airfields have come better, safer U. S. Royal Tires for every flyer!

# U.S. Royal Tires



**United States Rubber**

Distribution: London, New York 26, N. Y. In Canada: Dunlop Rubber Company, Ltd.



**2** During climb and level flight, low pressure cam must provide maximum fuel efficiency to assure the maximum range

**1** Immediate fuel power is required for split-second takeoff and vertical climb to extreme altitudes. The Holley three dimensional cam must automatically compensate for instantaneous changes in altitude and temperature.

**3** During combat, the camshaft surface of the three dimensional cam becomes the pilot's most sensitive assistant by automatically compensating for changes in pressure and temperature.

## How the Holley three dimensional cam functions as an automatic co-pilot

The job of the Holley Power Control for jet aircraft is to sensitively control engine power according to the pilot's requirements and, at the same time, make automatic adjustments for split-second variations in altitude, pressure and temperature. The "brain center" of advanced Holley controls is a three dimensional cam which is so contoured that it can adapt itself to all combinations of atmospheric temperature and pressure, from Thrust to the

Exhaust and from sea level to extreme altitudes.

In addition to the automatic compensations made for the pilot by the three dimensional cam, it interprets the pilot's request for changes in power. It's the most important link between cockpit and engine.

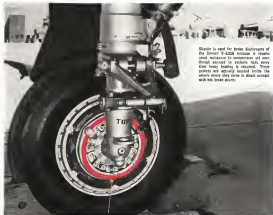
The three dimensional cam, like the power control shaft, is designed, engineered and manufactured by Holley—one of the world's foremost power control manufacturers.



Typical "brain center" is a Holley aircraft engine control from the variable fuel/air mixture. Each plays a vital role in automatically regulating the engine under varying conditions.

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Carburetor Co.

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Silastic is used for brake discbrakes of the Dornier 19-125B. Because it resists heat and oxidation at temperatures up to 500° F, it is used in areas where heat is very high. In fact, it is used in areas where heat is very high. In fact, it is used in areas where heat is very high. In fact, it is used in areas where heat is very high.

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**Typical Properties of Silastic for Gaskets**

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- Elongation, % 100 to 300
- Tear strength, lb/in 10 to 75
- Compression set, % @ 500°F 20 to 40
- Hardness range, durometer 50 to 80

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Mr. Raymond points to one of the standard General Electric 5-Star Tubes in a Viscount VOR motor. First U.S. airline to use turbo-prop Viscounts, Capital makes sure its electronic equipment matches these modern planes in quality and reliability.



**"Capital has a low equipment-removal rate  
... thanks to G-E 5-Star Tube reliability!"**

**Says:** Earl Raymond,

Manager of Maintenance, Capital Airlines.

"General Electric 5-Star Tubes deserve a big share of the credit for the very low unscheduled equipment removal rate on Capital Viscounts. The dependability and long life of these tubes save us time and money."

"Capital services all commercial lines gear regularly. But should a piece of equipment need unscheduled service, the entire unit must be replaced immediately and overhauled. This involves costly manhours . . . keeps equipment on the shelf . . . and even delays a flight."

"With General Electric 5-Star Tubes, we have just about done away with unscheduled service troubles due to tube failure. Capital has used these special high-reliability 5-Star tubes since they first appeared. Our experience shows they can be relied on to do their job, and do it well."

For reduced maintenance, fewer flight delays, specify G-E 5-Star Tubes as your next replacements! Your distributor stocks them. Electronic Components Division, General Electric Company, Schenectady 5, New York.

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**GENERAL ELECTRIC**



## Getting specific about gravity!

Picking apples fascinated Sir Isaac Newton. No doubt he enjoyed a few of them while devising his famous gravitational formulae. Newton's genius was with what came down, whereas aviation engineers today are primarily concerned with what goes up. Even so, the gravitational challenge is the same.

A jet plane, intercontinental missile—or anything that moves—usually loses the design stage too heavy for optimum performance. To be specific—the specific gravity of the material of construction is too high.

Now, with Titanium, the design engineers can cap-

ture the strength of alloy steel at barely more than half the weight. What's more, Titanium is unaffected by most corrosion . . . and is impervious to the deadly attack of sea water and marine atmospheres. Its coefficient of expansion is low . . . and it can withstand long-time operating temperatures as high as 1000°F.

All types of Titanium mill products, from feed to scientific tubing, are made by TMCA. With production going up and prices going down, now is a good time to design with Titanium. Technical literature on Titanium is available just by asking.

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Standard Equipment on the B-47, B-52,  
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All standard sizes. Moving seal on valve  
Sealed actuator protects motor. Explosion  
proof.

**4** good reasons why...  
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every transport is **HYDRO-AIRE** Inc. equipped



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Types include automatic pilot valves, pressure  
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High vapor/liquid ratio fuel booster and  
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on the F-104, F-105A, F-105B, B-52, the  
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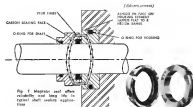


Fig. 1 Magnetic seal offers reliability and long life in typical shaft sealing applications.

## Aircraft Shaft Sealing Problem Solved Through Magnetics

*Force and wear are distributed evenly over entire face of new, effective, long-lasting magnetic shaft seal. Troublesome springs and packing are eliminated.*

By Edward A. Stevens  
Machinist, ASME

One of the most difficult problems in designing the powered elements of aircraft is making shafts against the loss of fluids, or their passage into areas where they may constitute vital operating parts. A wide variety of fluids must be sealed: fuels, lubricants of various types, hydraulic fluid, and others, under severe operating conditions.

In addition, the satisfactory function of gears and weights must be given full consideration.

By applying magnetics to this problem, designers have come up with an effective solution. The magnetic shaft seal takes extremely space because springs and packing are replaced by magnetic attraction between the shaft and bearing elements of the seal. Force is distributed evenly throughout the seal, so wear is even and even.



Fig. 2 Typical installation of magnetic shaft seal on aircraft generator. Rotational speeds do not impair effectiveness of seal.

and the seal, Fig. 2, performs reliably for much longer periods than spring-loaded and packed seals.

### Operating Principle

Now common to shaft sealing for aircraft applications, the magnetic force is applied to replace springs and to hold shaft and bearing elements together. A magnetized ring of Alnico V, with an O-ring packed on its outer surface, is inserted in the housing. Another ring is mounted on the shaft and held firmly against the Alnico element by magnetic force. A carbon ring in the face of the shaft element simulates the tapered surface of the magnet and forms a permanent, self-adjusting face seal.

An O-ring mounted inside the shaft element prevents the sealed fluid or gas from escaping along the shaft. The O-ring on the magnetic element keeps the fluid from leaking out the housing.

### Advantages of Magnetic Shaft Seal

Reliable, effective sealing is characteristic of the magnetic shaft seal. One of the elements of the seal is permanent magnet, so the sealing force is "built-in." No springs or screws are required. The sealing force is evenly distributed over the face of the seal. There's no face leakage initially, and the seal "wears in" over its entire life as mating parts longer than the life of the shaft.

It is more compact and lighter in weight than any conventional seal.

The carbon sealing disc is self-lubricating — runs cool and wears slowly.

### Typical Application of Magnetic Shaft Seal

Jack & Heintz, Inc., attacked a serious sealing problem in an aircraft generator. Generator rotors are cold continuously, the laminar and core components, failure unless the shaft were effectively sealed. Operating maximums called for a rotational speed of 12,000 rpm. Although the shaft was only 1 3/16 in. dia., only maximum axial space was available for the seal.

The solution was found in the magnetic shaft seal illustrated in Fig. 2. Effective, positive face sealing at high rotational speeds proved to be the ideal solution, yet the space required was half seal within the design requirements. The result is reliable, effective seal, and clean generator housing between overhaul periods.

### Specifications of Generator Shaft Seal

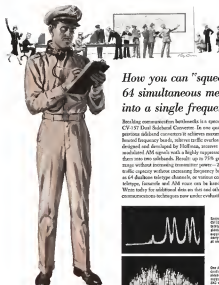
Rot. in/Sec	Output in	Input in
12,000	11.0	11.0
Temp. -10 (max)	20	20
SHAFT DIA. 1 3/16 IN.		
Material Steel		

### Additional Technical Information is Available

Send for our complete brochure on magnetic shaft seals.



MAGNETIC SEAL CORP.  
RICHMOND, CALIF.



## How you can "squeeze" 64 simultaneous messages into a single frequency

Beating communication bandwidths is a specialty of the Hoffman CV-157 Dual Sideband Converter. In one quarter the space of previous sideband converters it achieves maximum use of relay's limited frequency bands, achieves traffic overloads. The CV-157, designed and developed by Hoffman, converts independently modulated AM signals with a highly suppressed carrier and splits them into two sidebands. Result: up to 75% greater effective range without increasing transmitter power—2 to 53 times more traffic capacity without increasing frequency bandwidths. As many as 64 dual-tone multi-tone channels, or various combinations of voice, facsimile and AM voice can be handled by the CV-157. Write today for additional data on this and other advanced communications techniques now under evaluation at Hoffman.



Single channel taken from Hoffman CV-157 showing two carriers (voice) channels in upper portion, voice portion required. Each channel can carry 24 messages clear in the time.



One AM voice channel (voice) by continuous wave (voice) in each portion. With additional multiplexing equipment, the CV-157 handles 64 simultaneous dual-tone multi-tone channels.



All other on-line sideband dual-tone multi-tone channels (voice) in each portion. With additional multiplexing equipment, the CV-157 handles 64 simultaneous dual-tone multi-tone channels.

ALL FIGURES UNEXCEPTED FROM TALKING MODEL, 10-10

magnetic seal corp.

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High speed electronic data processing equipment helps the Enjay scientists solve your compounding problems in record time. In developing new products, or improving old ones, call on Enjay for top-notch assistance. Contact your Enjay representative for further information.



Enjay Butyl is the dependable rubber with outstanding resistance to aging, abrasion, tear, chipping, swelling, ozone and acids, and chemicals. It's also heat, cold, moisture, and superior.

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► USAF and Army are probing violence and danger of turbulence created by jet aircraft on takeoff.

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► USAF's Air Training Command is saving taxpayers an estimated \$11.5 million annually.

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Ben Peters for National Air Show ..... **21**

**COVER:** An anti-air piracy and missile-combat wing is two outstanding features of Convair's B-56. Hustle weapons system based on gliders of Convair F-102A. B-56 is relatively small-sized fighter, has ability to carry a wide variety of weapons or supersonic dash speeds. Although production status is still uncertain, Convair has first order from USAF for 11 airplanes, and probably considerable for more. For full story on B-56, plus exclusive pictures, see page 26.

Peter Cronin  
St. Lawrence, N.Y.

57,572 copies of this issue printed

**B.F. Goodrich**

NAVY



## New fuel cell baffles 11,900 lb. surge pressure

When the spectacular Douglas F4D flying takes off from a Navy carrier, it blows out and up at a second-inning pace.

Imagine the surge pressure set up in a longitudinal fuel cell by such a compact take-off—or during an arrested carrier landing. It would be sudden and devastating—so much as 11,900 pounds of surge pressure that would burst a conventional fuel cell.

Obviously, this problem had to be solved before entering one flight. Development engineers of the B. F. Goodrich Aviation Products Division, called in by Douglas, worked out a solution.

They designed a cell containing a series of special baffles, dividing the section into compartments. The baffles were reinforced with steel cables to soak up surge pressures and transmit them to the surface. The resulting B. F. Goodrich fuel cell contained

maximum strength with minimum weight. It is proving itself successful in every flight of a Phantom.

For the best solutions to your fuel cell problems, call upon experienced engineers of B. F. Goodrich Aviation Products.

## B.F. Goodrich Aviation Products

a division of The B. F. Goodrich Company, Akron, Ohio

Tires, wheels, brakes • Dr-shares • Safety belts, seats • Fuel cells • Antennae • Weathered Rubber Pressure Sealing Zipper • Shocks • Pneumatic cushions • Hoses and rubber accessories

## EDITORIAL

### Dim Future for National Air Show

For more than three years, there has been a strong tale of stagnation in the aircraft industry and the military services over the wisdom of continuing the National Aircraft Show in the traditional annual showcase for military and civil aviation.

The National Aircraft Show has done a good job of promoting the cause of adequate aerospace in its long history that goes back to the early 1920s when aviation was still staggering along in the spruce, dope and fabric and being wise on. The show has undergone a considerable metamorphosis since the present era when formation aerobics and closed course racing events are the principal attractions. Former efforts to revive closed course racing never really succeeded despite a brief experience with budget cuts and a regime of war surplus hot rods. When closed course racing was attempted with jet fighter types, it was quickly apparent that this was too dangerous to be continued. We recall vividly the structural battering Lockheed F80s and North American F86s took in their low level flight, streaking around the pylons marked course at Cleveland in 1948 and 1949.

Since the advent of aerospace and high-altitude performance aircraft, the problem of adequately demonstrating military aerospace for the public at low altitude has become increasingly difficult.

#### Lack of Purpose

In an editorial "Are Air Shows Necessary?" on Oct. 22 (p. 25) we noted that, of all the major international air shows, the National Air Show was most lacking in clarity of purpose and repeated industry and military sentiment for changing emphasis in the aerial arena.

During the past few years, the National Aircraft Show has been held together by the substantial participation of the Defense Department contributing USAF, Navy, Army and Marine aircraft for the spectacle and of the aircraft industry paying substantial fees for state exhibits of its products. Last week, indications from both these sources of support indicated they probably cannot be counted on to continue their backing of the show.

Aircraft Industries Association's Public Relations Advisory Committee, in making recommendations to AIAA's board of governors, voiced serious doubts over effectiveness of the show in achieving industry objectives.

This AIAA group listed the following major points of criticism:

- Unanimous agreement that recent shows have not been effective in industry objectives
- Some and supersonic aircraft with high altitude performance make flight demonstrations "totally impossible"
- Cost of industry exhibits is "excessively high" and benefits are "negligible."

• Display of newly developed aircraft frequently results in interruption of production and testing programs, is costly and necessitates diversion of valuable production and engineering manpower.

USAF's attitude, as reported by our military editor, Claude White, is that its objectives can be better served by devoting its resources to expanded Armed Forces Day activities centered at key locations throughout the country rather than by being concentrated in the area where the National Aircraft Show is playing its three-day stand.

#### What Does Future Hold?

Without full support from the aircraft industry and USAF, the National Aircraft Show can hardly hope to continue in its present form. If the Oklahoma City show last September proves to be the last, what will take the place of the National Aircraft Show?

Will an expanded, better planned and better executed series of Armed Forces Day displays do a better job of selling the role of aerospace to the American people than a centralized three-day annual aerial carnival? Does the aircraft industry need an annual display to sell its commercial products both at home and abroad similar to the British air show at Farnborough?

Can the aircraft industry and the military make a better pitch to the listening public by using television as a substitute for the National Aircraft Show? An interesting audience comparison could be drawn between the 151,000 citizens who paid to see the Oklahoma City show and the millions of Americans who are watching the current Columbia Broadcasting System "Air Power" television series each Sunday night at home without cost. Individual fees in the aircraft industry have gotten enormous public coverage from documentary style films used in public service presentations on television.

#### Public Relations Goals

We think a good healthy debate on the public relations goals of the aircraft industry and the military services and the measurement of the National Aircraft Show's effectiveness in achieving these goals will serve a useful purpose. Aviation is a field where a reluctance to change rapidly to meet new technical and social demands has spelled recent failure.

Military and commercial aerospace need a continuous, effective public relations program if they are to grow sufficiently to discharge their responsibilities. For it is the listening and ticket buying public that supports them both.

Talancing such a program to effectively achieve its goals calls for serious, professional thought. It just can't be done by amateurish spending bumptiousness.

—Robert Hutz







CONICAL under of B-58 Hustler is shown at left wingtip; aerodynamic feature reduces induced drag during cruise.

## B-58 Hustler Packs a Big Punch in a

By David A. Anderson

Cougar B-58 Hustler weapons system is a little airplane designed to perform big missions.

Into its ramjet-powered airplane Cougar designers have packed the ability to carry a wide variety of external pods equipped with offensive or defensive weapons at supersonic dash speeds over the target area. Its four General Electric J79 turbojets live in throat at through Mach 1 without cutting in the after burner.

It has armor—at least three full power—at F-105 chase plane which has a

speed capability of about Mach 1.4. These first customer photographs of the B-58 show many of its design features including:

- **Area-ruled geometry** which reduces resistance wave drag and makes the "nose wall" a low handle.
- **Conical-canard wings** which reduce induced drag at cruising speeds without compromising supersonic dash performance.
- **Axiosymmetric layout** based on the platform of the Cougar F-102A, scaled up by a factor of 1.4 to double the F-102A's wing area.
- **High-lift wing** goes to give clearance

between the potted engine and the ground on takeoff and landings at the usual high angle of attack.

- **Folded powerplants** with supersonic exhaust ducts which take on board all the air needed to feed the J79 engines and to cool and preheat the engine airframe and its intakes.

First flight of the Hustler was Nov. 11, a little less than first view after the latest USAF decision was made to go ahead with the bomber. Production status of the Hustler which has evolved as an emergency off-gate condition for several years, is still uncertain. Cougars live in three order for 15 airplanes,



HUSTLER folded by Cougar F-102 (left) and F-102A (right) shows small size of bomber compared to fighters.

## Small Frame

and undisturbed commitments for more.

The Hustler project was debated at Air Staff level for nearly a year before it was given high priority early in May 1954. It was also early in May 1954 that the first of the Korean long-range bombers, the Soviet Tu-16, made its public debut over Red Square.

### Minimum Size

The Hustler is actually a small airplane, its wingspan is 35 ft., comparable to the Northrop F-89 Scorpion when geometrically similar to the Cougar F-102 wing planform, the B-58's delta

surface measures about 1,470 sq. ft. in area, just about double that of the F-102. Wing area compares to that of the F-4U Corsair.

Maximum length of the Hustler from its sharply-pointed nose to its trailing swept tail is approximately 95 ft. The plane stands about 30 ft. high.

Standard crew is three: a pilot, a navigation bombardier and a defensive systems operator.

Powerplants for the Hustler are four General Electric J79 turbojets, rated about 12,000 lb. thrust each under sea level static conditions. This thrust, although reduced at altitude due to the lower air density, could be increased to values between 14,000 and 15,000 lb. per engine, using the afterburner fitted

The Hustler, at least the portion of it shown in these pictures, is a weapons carrier. It is primarily an aircraft with fuel and crew bay around a series of external pods that carry complete bomb-ordnance systems, missile systems, photo-reconnaissance system and others.

These pods have to have two fairly obvious characteristics: they must fit in the envelope defined by the nose gear and main gear, and they must not compromise the aerodynamic performance obtained through use of the area rule.

Consequently, these pods could be up to about 50 ft. long and about eight feet wide at absolute maximum. A pod using these dimensions would probably violate the wing area distribution, which



HUSTLER takes off for first flight at Cougar plant, Ft. Worth, shows high-lift leading gear for ground clearance.



MACELLES for potted C-29 J79 turbojets look large compared to fuselage size; are about 23 ft. long.



**DEAD stick deployed.** The B-57 shows its tail at the end of its landing run following the first flight.

would be acceptable for a piloted weapon system.

But for a weapon system that had to be carried to the target area and jerked down as a pod, the shape would probably have a high laminar flow and would be an aerodynamic blower in the belly.

That kind of a pod could only be about 30 in. long and would have to be narrower than the F-105 fuselage width.

Four of the first batch of B-57s will carry electronic countermeasures systems being developed by the Waldborn Laboratories of the Selkirk Electric Corp. The photo reconnaissance system is being developed by the Fairchild Camera and Instrument Corp.

#### Airframe Design

The aerodynamic layout of the Hunter has undergone a couple of major changes since its original concept. First was the narrowing of the fuselage, prompted when the Convair F-105 layout idea it was derived to work at, but not perfect, March 1. The podded engines, originally placed in large flat nacelles, were divided into four separate packages as one result of this aerodynamic redesign. Another change proved the necessity of the landing gear deck visible on the ground picture of the B-57.

The new revised idea represented the main-stream of the wing.

Several more change in the layout was the accommodation of control canopy (AW No. 76, p. 16) to reduce the drag due to lift during the reference cruise portion of the mission. Used as an early developed form on the B-18, control canopy also has been incorporated as a fit on the F-107A.

Control on the B-57 are like those of the F-102. Elements of the wing trailing edge control the airplane in roll and pitch. Noail trimmers are located on board on the trailing edges. A swept tail provides stability and control in yaw.

#### Simulated Hunter

The B-55 was "born" long before a true jet built.

Who was dead in two airplanes which were used to simulate the B-57 and other aircraft characteristics of the bomber.

Convair Aeronautical Laboratory used that a Lockheed F-94 as that it handled like the B-57. It was flown by B. A. Erickson, Convair chief test pilot and manager of flight for the F-107. Worth pilot who made the initial flight and subsequent flights of the test drag John C. Seal, Convair test pilot, made the proving flight before checking out Erickson in the F-94.

At Convair a Northrop F-59 Star was used in flight but the B-57 control system. Its engineers enabled Convair engineers to evaluate the power control system of the Hunter long before they could have otherwise.

#### Highly-Swept Nacelles

The four podded J79 powerplants are placed nacelles on the B-57 in unusual nacelles located to conform to its jet practice. The exhaust nacelles are mounted on high swept pylons that place most of the engine ahead of the wing leading edge. The exhaust nacelles are thick mounted to the under surface of the wing with the exhaust stack line up with the wing leading edge.

Maximum width of the egg-shaped

nacelles is about 42 in. overall length of the nacelles is about 22 ft.

There were three basic design considerations for the B-57 powerplants (AW June 4, p. 50).

- Variable inlet geometry automatically controlled to maintain maximum efficiency of the intake system throughout the mission profile.
- Separate air sub-system to handle and distribute the cooling and pressurizing air needed for the engine and its systems.

- Section analysis of the flow characteristics to get a total picture of heat loss and gas flow throughout the entire engine.
- Nozzle inlet has a control spike to force an induced shock at supersonic speeds. For maximum efficiency, the control spike should be moved so that the diagonal shock impinges on the nozzle lip.

#### Structure

All the air necessary to feed the engine and to cool or preheat the airplane comes in through the single inlet, that there are no other doors where where to draw the airplane.

Metal-bonded primary structure is used exclusively in the B-57, making up perhaps 1,000-1,200 sq. ft. of the plane's external surface. Most of this structure is riveted-together sandwich, it forms the main nacelles, the struts, the wing rear fuselage, and the main fuselage panels near the "hot" nose of the forward engine.

Some of the structural components are being built for Convair by Avco Aircraft Corp., under a contract for more than \$100,000.

Landing gear of the Hunter seems abnormally high at first glance. But a

close study shows that it is necessary, primarily because of a number of factors.

First, there is the high angle of attack that a delta-winged airplane takes during takeoff and landing. On the Convair F-102, the landing gear is near the rear of the fuselage, so that a large angle of attack won't rub the tail on the runway. But the B-57 has a limited wheelbase on the V10 fuselage, and that 40-ft. overhang could get very close to the runway if the gear went low.

Second, the induced nacelles clear the ground by less than four feet pulling in, the nacelles, and the outboard nacelles, although higher, would be close to the angle of attack overruns.

Third, there is always the possibility that an aerodynamically dirty pod would be acceptable for cruise mission. Such a pod would require extra ground clearance.

Each main gear of the B-57 has eight toes of only 23 in. diameter, weighing only 25 lb. each. They feature a roller (the tail) and the General Tire and Rubber Co., who developed them, say they carry more weight per wheel of more than any other developed in the history of the rubber industry.

The main gear retract into rectangular boxes in the wing. Six and a half of the gear indicators that run by hand, and retract about both its abutment point in the wing and the side of the logic gear, retract almost vertically.

There are 16 major operational fuel-inlet systems in the Hunter, which are all designed to operate almost automatically with a minimum of supervision.

These are separate from the weapon controls, control and engine.

- **Engine** systems, developed by Sikorsky for the division equipment and Emerson Electric for the aircraft.

- **The landing and navigation systems** were developed by Sperry Gyroscope Corp.

- **An conditioning and pressurization**, developed by Hamilton Standard Division of United Aircraft Corp. (The system controls heating, pressurizing and dehumidification of the cabin air, defogs the windshield, removes rain with an eraser and wicks the crew, all the mission gear and the wheel wells).

Texas Co. heat exchangers, weighing only 12 lb. each, are used during various types of missions for extra cooling capacity.

- **Antipilot and control**, developed by Bendix Aviation. The system uses a conventional antipilot developed by the Edgely-Patterson Division.

- **Electrical power**, developed by the Small Motors Division of the Westinghouse Electric Corp.

Other specific contributions to the Hunter program have been made by Minneapolis-Honeywell who developed a transmission fuel gauge, and the Aero Equipment Corp., who developed the oxygen-oxygen separator.

## Gaylord Will Head Bell Helicopter Corp.

**Bellevue, N. Y.**—Harvey Gaylord, general manager of Bell Aircraft Corp.'s Texas Division at Ft. Worth, Tex., will become president of the Bell Helicopter Corp. when the division reaches corporate status on Jan. 1.

Gaylord will continue as a director and vice president of the parent corporation.

The new subsidiary will have five vice presidents—Edward J. Duncanson, Executive Officer, C. B. Clark, R. H. Coleman and William G. Gault. Gault also will be secretary, and James F. Adams will be treasurer.

Directors will include Lesford Fawcett, president of Bell Aircraft and chairman of the new board, Gaylord, Gault, J. Frederick Schofield, Albert Fink, Edgar E. Stewart, Elliot, Jr., and Frederick F. Rebsom.

## SAC, ADC Assume Northeast Duties

**Washington**—Responsibilities at the Northeast Air Command will be divided between the Strategic Air Command and Air Defense Command sometime after Jan. 1 as part of Defense Department's plan to simplify and strengthen the nation's defense structure.

No major change in deployment of bases in the NEAC area, which has headquarters at Pope Air Force Base, Newburgh, is contemplated. The Air Defense Command will be responsible for planning and logistic support in the eastern region of the District of Columbia (DOW) Line and some similar responsibilities which might grow out of future only warning program.

## Navy Orders More Grumman Traders

**Navy** has ordered an additional 324 orders worth of Grumman T-73 Traders.

Delivery schedule calls for three of the cargo-passenger airplanes per month, starting in November 1957. These T-73s will see others of this type in the Fleet Logistic Air Wings as carrier transport aircraft, ferrying personnel and cargo between carrier and shore.

To offset the transmission stress that is caused by several engine landings, the Traders are equipped with "wing roots" instead of landing gear. A combination of movable ballast and steel bars, the cage will contain a 20-G load.



**BEAR UP.** Hunter heads over after takeoff on second flight No. 16 at Ft. Worth.

# AIA, USAF Decisions Threaten Future of National Aircraft Show

Washington—National Aircraft Show faces a dire future.

Public Relations Advisory Committee to the Air Force Industries Association has, for the first time, taken a firm stand against the show, viewing it a high-cost vehicle for industry with negligible benefits.

Convinced with a reversal in Air Force policy instigated by Secretary Donald A. Quarles, the union is expected to result in the withdrawal of Defense Department support from the annual (July-Dec) gathering. Quarles is expected to further USAF participation.

## FRAC Realization

A realization achieved by the Public Relations Advisory Committee continues in just recommendation that the AIA withhold sponsorship and financial support, leaving the question of participation up to the individual member companies.

In addition, however, the committee has made these observations about the show:

- There are widely differing opinions about the show's effectiveness and value.
- There is unanimous agreement that recent shows have not served effectively for industry objectives.
- Some and expensive aircraft with obvious potential make the flight demonstrations "totally impractical."
- Cost of exhibits exhibits "is extremely high in benefits not negligible."
- Degree of newly developed aircraft frequently results in technological, production and testing programs, in costly and unnecessary diversion of valuable production and engineering manpower.

## Why the Decline

Actual decline of the National Air Show, underwritten by the Air Force Association of Cleveland, Ohio, probably started with the end of official recognition in 1949. Plans that year, the Defense Department said, for the most part, by USAF—was taken over an increasing portion of the flying show.

The official attitude was that the show constituted a repeat in the tax picture. In the last few years, Army Aviation has taken part with enthusiasm as part of that service's effort to sell its fast-growing air program. The Navy traditionally has been a reluctant participant, going along solely to keep its flying lights from being dimmed by USAF.

At the 1956 show in Oklahoma City, there was no flying demonstration of

commercial aircraft of any kind for the first time. The show was an exhibition only of military capabilities (AW Sept. 10, p. 37). Attendance went down to 151,293, a sharp drop from the 1955 Philadelphia crowd of 230,836 for the two-day stand.

## Intensive Review

The Defense Department, eager to keep emphasis away from inter-service rivalry, was upset by the 1956 program.

Now need the show to meet up to the first show's expectations. Quarles estimates targets more than 2,500,000 in attendance.

USAF demonstrated that its B-47 can fly one-step high purely in North America and England and added a long-distance speed record by the 7-0-00.

The Army pointed out helicopters have considerable endurance with a

new record of approximately 38 hrs.

The Pentagon demands its future participation is up to a committee in which the small firms are represented. It was clear last week that the AIA committee, asked recently for its opinion, has declined its involvement of the show in order to guide the Pentagon group in making its decision. That and the attitude of Quarles appeared certain to result in Defense Department withdrawal.

Criticism of the event, aside from the safety problems—which were, for the most part, abolished with the end of showbusiness stunts—has been constant but steadily since the show at Dayton, Ohio, in 1953 and 1954.

More than two years ago, it was suggested that the Defense Department should get more effective publicity from a stronger effort on Armed Forces Day. It also was proposed that industry might benefit even by sponsoring an annual national television program to report on the year's technological and military progress.

Some consideration is still being given these programs.

## French Cite Atomic Weakness

Paris—Recent National Assembly debate on the 1957 budget brought out bitter complaints over the French lack of atomic weapons. Many of the deputies pointed to the Russian threat during the Soviet campaign to "atomic blackmail."

An even deeper pit of "Recent events have demonstrated that the right conditions possessing atomic weapons will be able to make their voters bleed."

Included in the French air force budget is an item of \$146 million for studies and the building of prototypes. Of that amount, \$18 million is allocated for guided missile work.

At Free Service House, LaFourest defended his budget spent on crises. While admitting that the number of combat squadrons is below target goals and that too income was expected, he pointed out that during 1957 French squadrons will be taking initial delivery of Super Mystere and the Venture as well as various fighter variants as well as a bomber version.

Thus, LaFourest argued, efficiency in the air will improve during the year although numbers will not.

"I agree," LaFourest said, "that that budget means a pause in crises over an air assault program, but it creates no great situation nor does it compromise the future of our small forces."

Despite his optimism, the government's 1957 air force budget of \$507 million was upheld. It represents an increase of \$55 million over 1956. The French military budget is based on the calendar year.

The government's critics were pushing for an air force budget of some \$580 million. They pointed out to decide that 1957 budget will represent only 26.6% of total military budget while U. S. Air Force needs account to 46.7% of the American budget and the Royal Air Force needs make up close to 15% of the British military budget. In all, the National Assembly asked a total military budget of \$2,515,000,000, which included \$507 million for air force, \$580 million for army, and \$157 for the navy.

Many critics in power the special Algerian campaign, which is costing the government about a million dollars daily, as well as Soviet campaign expenses, will be continued and expanded.

Deputy Louis Lefebvre, former air force secretary, spoke in debate on behalf of the Assembly's National Defense Committee. He revealed that present French combat aircraft strength is 40 units of powered jet. The committee, he said, not expected to increase during coming year nor would the air force be able to increase its present personnel strength of 146,300 men. Lefebvre further pointed out that France by 1960 was slated to have 60 combat squadrons in operation but trained will have only 48.

These 48 squadrons, he said, will have only 714 combat aircraft at their disposal instead of the nearly 1,000 as called for in planning goals.

He also noted that by 1961 West Germany's goal calls for approximately 1,280 combat aircraft.



New Dassault Mirage

Dassault's Mirage II is a light-weight supersonic fighter with delta wing configuration powered by a Soreau Atlas G engine with afterburner. Reported first flight top speed is Mach 1.5. Mirage exists in two other versions—Mirage I and II. These are present by combination jet and rocket engines. Mirage II made its first flight Nov. 19.

## Free Radical Research Spurred By New Three-Year Program

By Evert Clark

Washington—The major scientific event against the problems of controlling free radicals of chemicals will be strengthened considerably by a three year research program now being approved at the National Bureau of Standards.

Work with these high reactive or stable atoms and molecules may have significance in rocket propulsion, solid state physics, free chemistry and a number of other areas.

Industrial research laboratories will be called upon to supply approximately half of the technical staff on a loan basis. One hope is that the research will be continued and expanded by many of the industrial laboratories after the bureau's program comes to an end.

## Amplification Program

Other organizations will come from universities and government agencies. The exploration of free radicals both directly and in connection with other investigations, has been carried out by a number of universities for several years, some of it under the sponsorship of the military services.

The amplification program is an attempt to provide an integrated approach to the problems of formation, properties and decay of free radicals.

It is receiving Defense Department support and will be associated by Army's Office of Ordnance Research.

A Free Radical Research Section has been created at the Bureau of Standards, and, although the program

is still largely in the planning stage, some projects are already under way. The section is headed by Dr. Herbert F. Branda, who has done extensive research in the field, both for the bureau and for the Air Force Office of Scientific Research.

Among the Bureau's plans for a coordinated attack on the problem is a "Symposium on the Properties and Stabilization of Free Radicals," now scheduled for next Sept. 15-20. One aim of the conference is to bring out the role of free radicals in the earth's atmosphere. (AW Nov. 25, p. 32), work by Dr. Ratz at Catholic University and by Dr. Branda at the Bureau of Standards will be by Dr. Chik Kung and Dr. Samuel Fraser at Johns Hopkins University's Applied Physics Laboratory, and work on an AFOSR contract which demonstrated on a laboratory scale that would have been therefore direct) can be obtained from a reconnaissance available source.

Although the creation of free radicals has been known since about 1900, the first suggestion that controlled free radicals might have an application to rocket propulsion came in a proposal to the Air Force Office of Scientific Research from Dr. Fritz Zetzel, now a consultant to Armstrong-Govett Corp. (AW Dec. 5, p. 28).

## Rocket Fuel Study

USAF's Office of Scientific Research has contracts with Aerojet and Phillips Petroleum Corp. for direct investigation of all the possibilities. It also has contracts with 10 universities for exploration investigations in physical and chemistry to acquire basic knowledge about free

radicals and their role in natural phenomena. They are the University of Maryland, Laurel, in Greeter, Gaithersburg, University of St. Louis, Research Polymer Laboratories, Columbia, Washington, Maryland, Stanford, California and Boston University. The first AFOSR contract in this field dates back to 1952.

## Significant Progress

Significant progress with free radicals in the past year led to the decision to make a concerted attack on the problem.

Advances included experiments by the Geophysical Research Directorate of USAF's Cambridge Research Center with the release of stored radicals in the earth's atmosphere. (AW Nov. 25, p. 32), work by Dr. Ratz at Catholic University and by Dr. Branda at the Bureau of Standards will be by Dr. Chik Kung and Dr. Samuel Fraser at Johns Hopkins University's Applied Physics Laboratory, and work on an AFOSR contract which demonstrated on a laboratory scale that would have been therefore direct) can be obtained from a reconnaissance available source.

## Collier Trophy Awarded To Allen, Twining

Collier Trophy for the "greatest achievement in aviation in 1957" was awarded jointly to William M. Allen, president of Boeing Airplane Co., and General Nelson F. Twining, Air Force Chief of Staff. Allen and his associates were honored for "conception, development and quantity production of America's first all-jet long-range bomber, the Boeing B-52." General Twining and the Air Force were cited for sponsoring and making the strength program successful in 1955.





**TEST PILOT** Richard J. Follwell (left) of Beach No. 6, CONARC, operates ground control of QG-17 drone in vortex test. Follwell controls lateral and heading of drone; another ship controls drone in air during experiment. Mother ship is a Beach L-25. Drone control box (above) is mounted on test of L-25 aircraft.



**AIRIAL** view of control site shows drone, controller and Sikorsky HO4 used to transport control mechanisms to test site.

## Jet Vortices Present Light Plane Hazard

By Claude Witte

**Eglin AFB**, Fla.—U S Army and Air Force are probing the violence and danger of turbulence created by jet aircraft on takeoff in a series of experiments that may have an evolutionary effect upon air traffic controls.

Under the engineering direction of the Army Aviation Board at Ft. Rucker, Ala., a QG-17 drone is being flown at 110 mph, through the wingtip vortices of an F-100 fighter and F-47 medium jet bomber to determine the duration, characteristics and intensity of the turbulence. Claims of the tests being held here will outline subjects of the drone to some extent react in flight.

In interphone interviews by Aviation Week, it was clear that, under proper conditions, the drone can be rolled in search in 50 or 60 deg. from its normal altitude when it hits vortices within four or five seconds after the preceding aircraft has passed. At 1,000 ft., with an autopilot, the condition is quickly corrected. At low altitude, with a human pilot at the controls, the aircraft could be in danger of crashing.

### Test Conditions

Operating at an altitude of 1,000 ft. in the still air of early morning, the USAF planes have been flying inside trails through which the QG-17 drone is flown. The drone carries a 12-channel

and outflowgraph to record changes in acceleration on three axes, roll, pitch, yaw, upward and downward. No conditions have yet been published, pending study of the recorded results.

Army's interest in this project, already the subject of research by the National Advisory Committee for Aeronautics and the Royal Aircraft Establishment of Great Britain (RAF Jan. 16, p. 79) goes back to an accident in Canada last year. At that time a de Havilland Otter, taking off from an airport, soon after a C-119 jet fighter, was swirled. Three men were killed.

The conclusion of the accident investigation was that vortices left by the jet fighter were violent enough to wrap

the Otter's wings around the fuselage as it stalled. Later, a second Otter crash was attributed to a flap valve malfunction. Because of this, some doubt still was cast upon the results of the first crash probe. It did serve, however, to spur interest in the vortex problem.

### When Danger Is Greatest

Fundamental paradox already encountered in experiments with the F-100 is that the wingtip vortex is most turbulent when the preceding aircraft is in takeoff configuration. At relatively low altitude, flaps down and in climb attitude, the spreading columns of air in most severe.

As forward speed picks up, there is less danger of turbulence.

This phenomena has led to conflict, say engineers, among the experts on which design factor is most important in creating the condition. One school holds that the wing leading is crucial; another that gross wing area determines the amount of turbulence.

In the present experiments, the F-100 and F-47 were chosen to help solve this problem. Beach Aircraft Corp. has done some research on this aspect of the vortex in a B-17 and F-100, and Beach engineers are cooperating with the Army in the Eglin tests. The Beach staff and a Beaman broke up under strange circumstances in crossing the path of a B-47 fighter.

### F-100 Used

For the Eglin tests, the F-100 is flown by Capt. Roscoe Turner of the Air Force Operational Test Center at the Air Force (Naval Command). He is attached to the 124th Test Group (Fighter).

Turner's jet is equipped with air intake tanks under the wings, each

holding 12 two-minute grenades. He can fire a two-minute puff with each tank.

Flying at 300 ft., wheels and flaps down, he lets his tail stream the air through paths of interference. Earlier, the QG-17 drone, modified for the Army, by Texas Aircraft Corp., is put into the air by a ground operator three miles over far control by a mother plane, a Beach L-25. From the aircraft the drone operator directs the intervening plane into the smoke trail left by the F-100.

The drone's outflowgraph can be turned on and off by the operator as the L-25 intercepts. Its wings are made at right angles to the vortex and at a 45 deg. angle. For a third test, the F-100 passes under the drone and cuts up strongly in front so that the QG-17 hits the turbulence while being parallel to the vortex.

In this approach, it is possible to see that a marked longitudinal pitch in the plane occurs.

### Helicopter Observation

In addition to the outflowgraph record, visual observation of the vortex is made by helicopter. A Sikorsky HO4, which hovers about 1,000 ft. from the scene.

For safety, the drone is equipped for self destruction in case of mishap. It will dive into the ground if the mother plane loses control. In addition, the F-100 carries live ammunition and could shoot the plane down in an emergency.

In a theoretical formula devised by Beach engineers, the load imposed on the drone increases in direct proportion to the speed and lift generated by the F-100. A 50-deg. penetration of the vortexes will increase the up and down

loads. An angular penetration will displace them but add severe rolling moments.

The Eglin tests may prove the accuracy or inaccuracy of the Beach formula.

Some experts believe that such factors as temperature and humidity, as well as wind, may have an effect upon the severity of the vortex. None of these factors have been found, direct tested, so a small aircraft may go through the vortex safely, but small variations in the speed, elapsed time interval, altitude, and other factors could result in critical loads on the intervening aircraft.

### Scale Bomb Tests

Beach engineers have estimated, for example, that a small bomb generated 125 ft. under one of their light aircraft by a plane firing March 15 would be critical for the tail and canopy. Pressure created by the bomb would be in the neighborhood of 75 lb. per sq. ft. The Beach F5 Tardul Air, for example, has a tail designed to take a load of 67.5 lb. per sq. ft. It is anticipated that results of the Eglin tests in the air will be classified, presumably because the phenomena could be used as a weapon.

Army's Aviation Board, headed by Col. Robert R. Williams at Ft. Rucker, Ala., suffers no illusions that the Eglin tests will be conclusive. It expects that, once the records are studied and checked, they will indicate little more than the direction that should be followed in future research.

Project officer for the Board is Capt. Robert E. Head. Technical direction is under Maxine J. Fetter, the Board's chief assistant of captain.



**QG-17 DRONE** banking at Eglin AFB after vortex test. Drone carries outflowgraph to record altitude changes.

## Single Manager Plan Adopted for Airlift

Washington—Defense Department last week indicated the single manager concept applied to airlift and named USAF's NAVJCS Air Transport Service as the principal airlift agency. Air Force Secretary Donald A. Quarles was designated the manager.

The airlift is either transferring both heavy transport aircraft of the 1300th Central Command (the Air Force's Tactical Air Command) and various foreign airlift aircraft of Navy's Fleet Logistics Air Wing (Flagship) to the air.

The Defense Department said "airlift transport aircraft" will be transferred to the new NAVJCS after its newly assigned aircraft become operational.

Terms of reference detailing the operations and exactly what aircraft will be assigned have not been completed.

NAVJCS is directed to go "full out" to the airlift service and able to Defense Department from U.S. or foreign air.

The Defense Department said the new concept is designed to strengthen military readiness, ensure greater effectiveness, efficiency and economy in airlift.

The doctrine authorizing the change is in accordance with Executive Commission recommendations on elimination of duplicating in transport services.

## Beech Sales Record

Wichita—Record high of 140 million is projected aircraft sales, primarily business and utility planes, has been achieved for 1976 by Beech Aircraft Corp. The new record, up 40 million over 1975, actually is more 90 million more than the 1976 quota set for the company's distribution and dealer to reach President Jimmy Carter. Both in three record sales meeting last winter.

New models of the company's best-selling aircraft line in its sales force at the 1976 annual meeting at Wichita Dec. 14-15.

• B30 Twin Bonanza powered by 240-hp, turbocharged Lycoming providing a top speed of 240 mph and cruise speed of 210 mph. In 1976, power was initially provided by Avco Lycoming, now 24, p. 20. Standard 170-hp and 200-hp high torque Lycoming will also be available.

• New H35 Bonanza has 240-hp, turbocharged giving a top speed of 240 mph. Range is 1,775 mi. with auxiliary tanks.

• T35 Super II has a 125-hp engine in range will now be 1,135 mi. range with 45 min. cruise.

## J54 150 Hour Test

Knox City—Washington J54 turbojet engine has passed an extended 150-hour endurance test at the Republic's Avionics Gas Turbine Division plant here. The J54 also has made its initial flight test in a full supported test by a North American B-45 jet bomber converted in a flight test bed for experimental jet engine.

The J54 is a greatly advanced development of Washington's current aircraft, a high efficiency turbojet in the 4,000 lb. thrust class. To date, the Republic has spent \$15 million in new funds on development of the J54 and an additional \$10 million in engineering facilities.

With Seattle, Washington's new product and ground operations of the Avionics Gas Turbine Division, will the extended 150-hour test run according to schedule specifications for a production qualification test but that the primary purpose of the test was to prove engine durability.

"During the test series run, we have been working on development of various engine control systems and methods of reducing noise on a more production basis," Smith said. "The J54 is the first engine designed specifically to take full advantage of these lightweight alloys. This test verified our conviction that through the use of titanium it is possible to build a very light jet engine without sacrificing efficiency, jet thrust or engine durability."

An endurance test will be completed, under which new, will put into a new engine field for the service this engine.

The doctrine authorizing airlift services under a single manager was promulgated in strong disagreement with NAVJCS and Flagship as to whether the engine should be done, and, if so, how. The J54 is a new engine designed by Defense Secretary Charles E. Wilson last November.

Although the doctrine said the engine was to be whether the single manager system will be and considerable budgeting was done in still expanded new engine Flagship will release for administrative work, for instance, is a question that probably will have to be settled at a high level in the Defense Department.

The Tactical Air Command's name on the transfer of its heavy transport aircraft—presently has engine C-124—has not been used but both Navy and NAVJCS will likely to require the single manager concept. The Navy did not want to give up control of its planes. NAVJCS officials said that the single manager and industrial funding concepts would create more problems both administrative and financial than they would solve.

NAVJCS will continue to operate the Air Photographic and Mapping Service, Air Reconnaissance Service, Air Weather Service, and Avionics, Air Communications Service and Flight Service.

## News Digest

Douglas Aircraft Co. predicts a 10% increase in expenditures from 2,800 to 3,600, at its El Segundo Division during the next four years.

FI-49 Prey jet has made its first

flight. The Prey will be produced at North American Avionics Corporation (NAAC) Division for service with carrier-based attack operations.

Chrysler and Ohio Krypton has bought a 55.5 million interest in Shale Aircraft, choosing as a result of negotiations (AIA Dec. 10, p. 79). A total of 55.5 million in negotiations will be made by Shale next month and will be convertible into Shale common stock after Jan. 1, 1977.

Chavez-Vazquez Aircraft, Dallas, Tex., has received its first Navy production contract for the Regulus 2 supersonic surface-to-surface missile. The Regulus 2 is powered by Pratt & Whitney J57.

Personnel of Northrup Aircraft will get a wage increase as a result of company's membership in its cost-of-living plan.

## KRM Training Unit

Washington—USAF's Western Development Division of the Air Research and Development Command will move into its program to increase operational capability with long-range ballistic missiles next year.

Last week, a major portion of Camp Cooke Military Reservation in California was shifted from base to Air Force production. Next month a program of modernization will be started in fact. The base will be known as the sample units. The base located near Lancaster, Calif., has been converted.

The Western Development Division is commanded by Maj. Gen. J. A. Schriener. Its mission is to develop both the KRM and KRM-2000 weapon systems and carry the projects through to the stage where operational needs are ready for assignment to the appropriate USAF command.

# NEW EEMCO MOTOR

for new missile



SPECIFICATIONS FOR TYPE G 030

Type: DC motor with integral gear reduction  
 In-line voltage: 24  
 Resistance: 4.8 ohms  
 Supply: 24VDC 1000 maximum  
 Duty Cycle: 10 min. on, 30 min. off  
 Ambient temperature range: -55°F to 125°F  
 Minimum starting torque: 200% of running torque  
 Mounting: per MIL-STD-883C  
 Cooling: fan cooled with open air circulation  
 Weight: 2.75 pounds

## Electrical Engineering and Manufacturing Corp.

4412 West Jefferson Boulevard  
 Los Angeles 10, California  
 Telephone: (213) 241-1111

EEMCO TYPE G 030, a DC motor with integral gear reduction, was designed for use in missiles of the latest concept. Like all EEMCO motors, as well as EEMCO's solenoids and linear actuators, it packs maximum performance into minimum dimensions and weight. With a physical output of 24, Type G 030 produces 4.8 HP at 200 rpm with a maximum RPM output of 2800. Duty cycle is 10 minutes on and 30 minutes off, with minimum starting torque at 200% of running torque. Ambient temperature range is -55°F to 125°F Fahrenheit. Type G 030 is fan cooled with open air circulation.

EEMCO has had many years experience in the exclusive design and manufacture of solenoids and actuators. As a result, EEMCO is thoroughly skilled and equipped to produce these vital components that must operate reliably under the extreme environmental conditions encountered in today's aerospace vehicles and missiles. Now EEMCO's extensive specialization in this field is playing an important part in the reliability of the most modern air weapons now being produced for the nation's defense.

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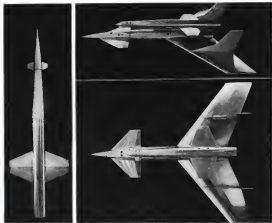


**DOLLAR ENGINEERING**—Advanced aerial weapons bearing the Northrop name are developed to achieve maximum economy through ease of production, maintenance, and operation. A notable example is the new Navaho missile now being developed by Northrop for the U. S. Air Force. Light in weight and low in cost, this airplane embodies a basic concept which can result in a whole new family of effective aerial weapons, all based by the same principle of simple and economical design. Since national defense dollars and national manpower are in short supply Northrop will continue to introduce the dollar into the engineering equation, will continue to employ "dollar engineering" in using the best science and technology to create the low-cost solution to a national defense problem and produce more Air Force per dollar of national defense budget.



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### Navaho Configurations

Two wind tunnel models for configuration studies in North American Aviation's Navaho SM-64 program were shown by the company at the recent New York Power Show. Model at left is apparently a study of usual aerodynamic and approximate as early proposed layout of the Navaho missile. At right is a modified model of a proposed swept powered missile wing in a curved, swept-back position. This is believed to be a means of convenience for the display and not representative of any Navaho configuration. The

latest aircraft could have been one of the steps in the study of layouts for the X-15 missile test vehicle, or it might have been a further development of the Navaho cruise proposals. Navaho test vehicles now flying at the Point Mugu Test Center on the California coast with the way, mounted with a large delta wing to make the wing thicker at a vertical tail. Receipts are at the wing root and the booster rocket is a detachable package under the fuselage. North American X-15 tests are substantially complete.

living program for hourly rated workers. Should the general Consumer Price Index of 147.7 points prevail on Dec. 15, workers will get a 1% cost-of-living increase that will become effective Jan. 15, 1957.

Contract of \$396,880 has been awarded by Chance Vought Aircraft to the T. C. Bennett Construction Co., Dallas, for construction of a building to house the company's new Mach 3 wind tunnel.

Rolls-Royce engine has completed 1,000 hours of development testing in past year. When installed in a Bristol Britannia aircraft for over 50 hours of this test.

Titanium Fabrication Inc., Berkeley, Calif., has received a \$174,000 contract from General Dynamics of General Dynamics Corp. for various missile components.

New Terrain missile now designed, tested, and put into production by Convair even before first version was placed out of production at the Pomona, Calif., facility.

Third prototype of the Bristol Type 173 helicopter has made its first flight. It is the first of the series to be powered by 550 hp. Alvis Leonides Major engines.

North American Aviation Inc. voted

a regular quarterly dividend of 40 cents per share payable Jan. 7, 1957 to stockholders of record Dec. 17, 1956. Company also announced that its 17,800 salaried employees would receive a 3.2% cost-of-living pay boost in their base salaries beginning Dec. 17.

French aircraft builder Messier-Sudavia announced it has signed a contract with the Argentine government for the delivery of 48 of its two-seat F4U biplane aircraft. Actual assembly of the planes will take place in the Argentine state-owned aircraft plant at Cordoba. Contract also provides that up to June 30 of next year the Argentine government can lease the order from 45 to 100.

# Smooth Pilot Transition to Jets Expected

By Irving Stone

Los Angeles—Transition training for jet transports will not present any more problems than transition from one propeller-powered transport to another.

A 51 (T-10) Johnston, Boeing Airplane Company's chief of flight test, made this prediction before a Los Angeles symposium attended by about 700 industry engineers, pilots and administrators. The meeting was sponsored by the University of California's Institute of Transportation and Traffic Engineering in cooperation with the Aeronautical Engineering Association and the Institute of the Aeronautical Sciences. Johnston based his findings on check-out in the Boeing 737 jet of approx- imately 130 pilots representing 25 major airlines all over the world. About 90% of these pilots had not added previously in jet aircraft.

Testamentations required to monitor jet engine performance is very simple, Johnston pointed out. Instruments are attached with propellers, carburetors, pistons, exhaust lead temperatures and engine temperatures are checked. Power response on ground operations is sufficient to what the pilot is now accustomed with piston engines. The Pratt & Whitney T37, he said, flies at 60% rpm, delivering only about 5% thrust, a desirable feature, so that approach will not be too flat. Accidents from low take-off to full power is advised.

in 4 to 5 sec., same as that for a piston engine.

In a test with the 737 at a landing weight of 150,000 lb., regular takeoffs were achieved at only one knot in excess of that for the DC-6, Johnston revealed.

In the transition program, Boeing now believes there will be complete ground school instruction. Pilots will become thoroughly familiar with the aircraft systems and their interrelations, plus performance capabilities and limitations. This will be followed by flight training, which should average about 10 hr., Johnston said.

The simulator is a very important tool in pilot transition training and can use a variable aircraft line, he said. Jet fuels that cockpit instrumentation are introduced with an environmental trainer instead of a full-fledged simulator.

## Pilot Overload

Altitude misstatements will be inadequate, but Johnston feels that can be accomplished as ground school with one of an altitude simulator. He doubts if it will be necessary to subject the pilot to explosive decompression, and tests that tests on time to act and effects on lack of oxygen will be sufficient.

Johnston advised that Boeing is asking a money price for the course mounted in the 737 in the pilot's hands. As a training aid, that will save the transition pilot what he is going to experience in talent, experience

and various other flight rigors.

Numbers of instruments and controls have increased more rapidly than the speed of aircraft, and the pilot is overloaded, according to Jose Griesley, vice president, Flight and Associates, business engineering and operations research firm. Real problem is that the pilot gets detailed bits of information and must relate this data and come to a decision.

## Pilot Evolution

Griesley indicated that instrument assignment should not necessarily be left to the role of a commander, but rather that pilots should evolve it in a simulator and in the air. Standards of instrument assignment arrived at by a committee may indicate an approach and do not mean that this is the way of getting a job done, he pointed out.

There is a real need for detailed study of pilot reaction to instrument to discuss before they actually go into operation. If this had been done to current systems, it would have been discussed that they are inadequate in certain respects, he claimed.

An example of this, he said, is the wrong layout of the instruments. He contended that the engine gauge should once again be the basic instrument. Emphasis of jet transports has been a big problem, and M. C. Brand, senior vice president, equipment research,

American Airlines. Introducing of jets may be limited more by financial considerations than the manufacturer's ability to produce them, he pointed out.

An traffic control will be transport's most knotty problem, although it appears that this difficulty is now on its way to solution by the time pilots will be in the picture in large numbers, Brand said. He added that even before he has much research and planning over been given to a new transport era.

## Altitude Dilemma

The first flight of jet transports will spotlight the altitude data bugs and low level terrain areas, he contended. Much data has been accumulated on altitude operations (below 25,000 ft.) and it is not expected that structural failure or explosive decompression will occur.

Safety aspects of altitude as a hazard are desirable, but because of its geographic characteristics, systems will have to be designed to avoid blockage by air. Concentrating on the subject of regional airports, Brand said it would be a long time before the speed threshold of the local transport might be needed.

Real problem will come in the adequacy of facilities to permit jet operations as an extensive overhaul. Frank, Richard P. Congress, Air Line Pilots Association, Chairman of the Los Angeles, said the meeting. It is to the issue of facilities that brand and some sweeping changes will have to be made.

It is possible not going on ahead to the end of the "localization" in parties, say the concepts that will need to be adopted, all out, or even large scale, jet operations," he said. Air line pilots, according to Griesley, feel they are going to support.

• Air traffic control system capable of handling today's demands more, many times over.

- More adequate airports and airport facilities.
- Better navigational equipment.
- Improved weather forecasting.
- Communications equipment to provide improvements jet operations will demand.

## Subsistence Flight

Jet transport operational requirements cannot neglect basic factors, which in many instances should be predominant in flight deck and instrument arrangement, crew complement and flight time limits, he claimed.

While experts indicate that jets are no harder to fly than conventional aircraft that can be developed if accepted as a complete wilderness, safety without other considerations, however, in jet events will occur crash busts, and greater pressure will be placed on operations and crew member demands, Griesley said.

Extensive studies are being made as to the advisability of at least one pilot using oxygen at all times, he declared.

A cockpit area will be needed for air transports at the high altitude Mach numbers. Before the big jump can be made to supersonic speeds, the problem of drag and temperature will have to be solved, according to Dr. A. J. Klein, design consultant to vice president of engineering, Douglas Aircraft Co. Keeping the passengers cool at supersonic speeds will be expensive. Boundary layer were become a very important factor in noise control even at high subsonic speeds, he pointed out, and this noise will have to be brought down to a suitable level. One alternative is that the aircraft have a light will lower the degree of comfort that normally would have to be achieved.

## Passenger Increases

A 1960 forecast of 65 million passengers and a 1975 forecast of 93 million passengers are realistic ones for the domestic industry, declared Lester W. Burton, Jr., an advisor to the University of California, Los Angeles, and member of the Administration of Civil Aeronautics II helicopter or other aircraft types will be needed to effectively develop the true short-haul market, these forecasts may be low, he pointed out.

Accuracy of transportation will become increasingly important as more aircraft begin to use the jet, flying closer together due to space-saving features of jet engines. Robert H. Tippet, director of office of CAA's operations facilities, told the meeting. New guidelines have made it necessary to buy five new aircraft which can be used in that 20,000 ft. Tippet declared. CAA also has added two B-77s to check return performance at 40,000 ft.

Radio frequencies, he said, must be increased or there will be a significant supply. Careful planning of frequencies

requires close coordination with users to avoid congestion due to interference which would render a New York or a voice communication channel unusable and unsafe.

Striving the importance of radio as the biggest single factor in solving air traffic control problems in the future, he said, is that it is essential that radio along with other in-progress improvements in the aircraft must increase the capacity of the system by four times. This depends on the question that expert agencies pay with the capacity of the air traffic control system.

## Export Bank Grants First Foreign Jet Loan

Washington—Export-Import Bank made its first loan for a foreign jet aircraft, a U. S. jet transport last week for \$16.5 million to Japan. Air Lines for its DC-8 order.

The bank also made a \$7.7 million credit to help the Japanese carrier pay for the four DC-8s it has on order from the Export-Import Bank and a purchase total \$42.5 million with interest.

Under terms of the loan, IAL must make an initial down payment of 25% of the purchase price, and the Export-Import Bank has to carry 25% of the financing. The loan over the full term of the financing.

The money for the four DC-8s is to be repaid in semi-annual installments over a seven year period beginning in 1969. The DC-8s loan is for five years, repayable in semi-annual installments starting in 1970.

In a similar move, the Export-Import Bank reported \$5.5 million to Finance to fund jet aircraft to help the airline pay for the four DC-8s it will receive next spring. The five-year Finance loan was guaranteed by the Latin American bank.

## Hangar, Shop Loans Authorized

Washington—James Pyle, Acting Civil Aeronautics Administration, has approved an agreement with the Small Business Administration authorizing loan to flight schools and air service operators for the construction of hangars, shops and classrooms.

In the agreement, the Small Business Administration has agreed the participation of local banks in financing the loan although this is not a requisite. However, the loan is to be used for a complete wilderness, safety without other considerations, however, in jet events will occur crash busts, and greater pressure will be placed on operations and crew member demands, Griesley said.

With no bank participation, the SBA will lend up to \$20,000 at 6% interest. Repayment can be arranged on an annual basis over a period of 10 years.

Pyle and the Federal Air Airport Act does not provide funds for such facilities. The operation previously have been hampered in borrowing funds because buildings are often located on leased land. However, such building property will now qualify for loans of the loan from SBA's representatives.

CAA field offices will be equipped to assist applicants in obtaining loan under the plan, Pyle said. According to Air Craft Owners and Pilots Assn., as estimated \$90 million in needed aircraft



REAR QUARTER view of Pratt & Whitney T37 check out power. Boeing 737 descent at Los Angeles transition check power stages. The first low pressure compressor stage from the flow down to the engine pack-fuel high-pressure compressor, also which it is difficult not to the combustion case, and if it is shown. Pratt introduced in the rear view of the combustion case from and stage. The three turbine stages are hidden by this casing and the three propeller turbine is missing. This outflow T37 currently is on display at the Museum's Institute of Technology.





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ming from Madrid, and on occasion routes to North Africa, Mediterranean islands and the French Riviera.

►British Overseas Airways Corp. will introduce sleeper seats on its first-class Argoset service to West Africa in January. Stateroom service will be inaugurated on BOAC's London-Lagos and London-Accra routes in April.

►Continental Air Lines has broken ground for its new \$17.5 million overhaul and maintenance base at Los Angeles. First stage of construction is scheduled for completion by April 1957, in time for the inauguration of service between Los Angeles and Denver, Kansas City and Chicago.

►International Air Transport Ass. has issued a second edition of its IATA Publication Policy Manual.

►KLM Royal Dutch Airlines predicts first 1-25 million tickets will exceed about \$179,000,000 in the Caribbean over this winter.

►Lima Aero Nacional de Chile has ordered four DC-6Bs by delivery during the last half of 1956. Delivery of the \$6 million order will give LAN a fleet of seven DC-6Bs. The LAN purchase brings Douglas orders for DC-6s/7s across America to 173.

►Northeast Airlines reports an 11.5% increase in passenger traffic for November. The airline carried 43,961 passengers in November as compared with 39,147 passengers in November 1955.

►Oreck Air Lines' passenger traffic rose from 22,139 passengers in November, 1955, to 27,759 last month for a 26% increase.

►Pacific Airlines carried 5,626,280 lb of cargo in November, a 28% increase over October and an increase of 184% over cargo traffic in November 1955.

►Recent Airlines' operating revenues were \$99,173 in November, a 45% rise over the same month last year. In the past five months, Recent has reduced its long-term debt from \$1,715,000 to \$2,194,000 and has increased net working capital from \$38,755 to over \$1 million.

►San Francisco International Airport's passenger traffic increased 35% between October 1955, and last October, while aircraft arrivals and departures increased only 9.4%.

►United Air Lines has signed an initial agreement with PIA Airways, a carrier which serves key cities on the PIA flights.

## AIRLINE OBSERVER

►TWA World Air Lines pilots are flying into Cuba and TWA Air to a schedule both only. Each captain is provided \$50,000 life insurance by the airline, with co-pilots and relief pilots receiving \$25,000. In the event of retirement, each pilot will receive \$55 hours per year at the rate of his monthly guarantee. Service to the two cities was discontinued on Oct. 30. It was resumed into TWA Dec. 7, Cuba on Dec. 9 (AW Dec. 11, p. 18).

►Airline profits for 1956 will show an improvement over last year and may even reflect despite an expected 12% increase in passenger miles. The rise in expenses is outstripping revenue increase, counteracting a trend that took a sharp turn for the worse during the third quarter of 1956.

►Delivery of Capital Airlines' original order of 60 Viscounts will be completed within two weeks of the Jan. 1 target date set two years ago by Vietnam-Americans when the contract was signed. The 51st aircraft was scheduled to arrive in Washington last week.

►Military Air Transport Service has awarded contracts totaling \$7,600,000 to an Airline for Airline and Pacific airlift. Service contracts were awarded to 31 other airlines to handle airlift on call for MATS.

►TWA World Air Lines has applied to the Civil Aeronautics Board for authority to suspend its international flights between Chicago and Detroit from Dec. 27 to May 15. The route was opened in May 1946, but was temporarily suspended during the winter season of 1949 through 1954. Last year, the airline resumed the flights and experienced a steadily less hectic schedule as low as 5% out of Chicago, 10% out of Detroit. Last January, the flights, which operate once a week to Paris, Zurich, Rome, Athens and Cairo, served on most from Chicago. Passenger average was 1.7 per trip from Detroit, and average 5 lbs. per passenger 5.7 over the same period.

►Bureau purchase by Northwest Airlines (AW Dec. 10, p. 41), plus latest order for two of the technology transports by, Thuring-Clin Air Transport, bring total sales of the fiscal month to 61.

►Pan American World Airways will discontinue jet stream flights across the Pacific and to Hong Kong. The routes are replaced with DC-7Cs. Extra fuel reserves and multiple crews that are not needed when a stop is made at Wake Island make the Boeing jet stream flights uneconomical. Use of the jet stream cuts flying time from a scheduled 18 hr. to 16 hr. or less on Tokyo-Honolulu flights.

►Canada's Department of Transport may be split into two ministerial categories, with one department handling other transportation, the other telecommunications, aviation and railroads. Lloyd Chever, former minister of transport and now chairman of the Canadian St. Lawrence Seaway Authority, is expected to head the new telecommunications department.

►International Civil Aviation Organization may assume responsibility for legal problems concerning outer space. The organization's legal committee has agreed to include the subject in its general work program next year in the future.

►Port of New York Authority will sell, for bids in a few weeks for a \$100 million cargo building at New York International Airport (Idlewild). Original plans called for three buildings with the fourth being added as construction began. The IFA building is necessary since thousands of space ships are outstripping existing facilities.

►Air Transport Ass. has proposed a revised dues formula for members that will provide a more equitable charge to all-cargo carriers who have recently become members of the association. The new formula sets 300% of income based on a basis for flying profits over its members. However, only 50% of the dues based on income based on its domestic service will be applied in calculating overall charges to be provided.

# CAPABILITIES . . . Manpower, Tools and Experience

The amazing photograph at right was taken by Tom Ashby, managing editor of *Flight Magazine*, at the Vincent Aircraft Show in Oklahoma City over the Labor Day weekend. It shows a U. S. Army L-23 Beechcraft making a successful takeoff and climb over a simulated obstacle, represented by the two poles. A previous takeoff by another airline plane had cut the upper ribbon which the photo shows is broken. The number in the line of the pole represents the distance in yards from the beginning of the takeoff run of the L-23.

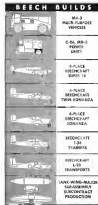


The U. S. Army L-23B transport, rugged utility version of the famous Beechcraft Twin Bonanza, has a proved and distinguished record of service. First ordered into military production in 1952, the L-23 was the first twin-engine airplane used by the Army Field Forces. From the battle fields of Korea to the training fields at home, and back again to foreign stations, the L-23 has met the exacting demands of military service with distinction. Today, the Army's confidence in the L-23's dependability and superior performance has resulted in new orders to fill the Army Aviation Division's expanding needs.

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## Airline Income and Expenses — 3rd Quarter 1956

	Passenger Revenue	Mail Revenue	Express Revenue	Freight Revenue	Subsidy	Total Operating Income	Total Operating Expenses	Net Operating Income (Before taxes)
<b>DOMESTIC TRAFFIC</b>								
American	\$47,357,540	\$1,371,840	\$933,389	\$1,818,147	0	\$51,480,916	\$42,000,941	\$9,479,975
Boeing	15,189,327	381,327	147,101	282,345		15,999,100	15,000,944	998,156
Capital	15,341,815	345,270	211,000	108,891		15,906,976	15,000,944	906,032
Continental	6,349,771	137,845	2,700	184,845	105,378	6,730,539	6,201,887	528,652
Delta	16,343,158	339,337	367,121	664,709		17,314,325	16,077,116	1,237,209
Eastern	45,418,415	856,632	467,271	726,227		\$47,468,545	\$41,191,779	\$6,276,766
Midwest	9,331,075	166,549	44,700	168,341		9,610,665	9,056,007	554,658
Northeast	2,537,719	77,337	27,089	38,800	345,601	2,937,546	2,946,416	(8,870)
Northwest	15,123,303	238,719	221,488	311,488		15,904,998	15,176,383	728,615
Trans World	44,373,413	931,619	765,166	1,831,895		\$47,891,093	\$41,191,779	\$6,699,314
United	41,394,115	3,004,402	1,067,157	2,708,444		\$48,174,118	\$41,191,779	\$6,982,339
Western								
<b>INTERNATIONAL</b>								
American	1,133,447	22,839		191,874		1,448,160	1,223,764	224,396
Boeing	1,438,320	79,123		10,870	248,447	1,766,760	1,486,346	280,414
Continental Atlantic	350,499	4,364		10,819		365,682	315,181	50,501
Delta	1,094,384	14,818		10,439		1,119,641	1,149,489	(29,848)
Eastern	4,172,382	37,449		31,311		4,241,142	3,429,419	811,723
Midwest	747,270	3,126	3,182	21,643		774,221	705,414	68,807
Northwest	1,453,681	1,845,507	14,571	900,411		3,714,169	3,109,527	604,642
Trans World	1,204,378	28,819		271,740	204,375	1,709,312	1,486,148	223,164
United	31,743,980	2,314,173		2,067,763	124,412	\$38,149,338	\$35,837,790	\$2,311,548
Western	14,476,791	1,233,609		1,435,430	280,310	16,426,140	15,893,783	532,357
Boeing	17,476,334	647,627		2,343,243	1,094,070	\$21,561,274	\$21,464,584	96,690
Capital	3,472,407	531,702		315,364		4,319,473	4,486,119	(166,646)
Trans World	18,335,321	1,044,128		919,343	214,464	\$20,539,256	\$19,888,489	650,767
United	4,075,798	81,708		47,327	4,072,309	8,276,142	8,216,783	59,359
<b>LOCAL SERVICE</b>								
American	1,390,405	30,154	10,438	17,329	407,754	1,786,100	1,644,237	141,863
Boeing	416,000	8,109	5,023	13,206	139,143	571,481	534,770	36,711
Capital	352,010	5,147	3,564	5,643	158,981	635,345	606,075	29,270
Continental	314,186	37,318	8,100	43,123	129,441	512,148	471,242	40,906
Delta	347,100	9,068	17,812	30,368	127,351	522,639	505,740	16,899
Eastern	1,112,777	12,612	12,418	107,351	1,399,160	1,634,268	1,547,987	86,281
Midwest	1,414,122	41,421	37,437	176,349	379,741	1,968,670	1,879,741	88,929
Northwest	830,141	23,957	17,331	31,469	147,414	1,029,312	1,008,809	120,503
United	1,137,207	22,779	17,253	43,220	2,136,600	2,456,860	2,403,044	53,816
Western	323,750	15,313	15,313	43,220	43,220	432,816	432,816	0
Boeing	691,487	25,114	15,364	10,419	1,478,813	1,731,183	1,731,183	0
Capital	165,611	27,479	11,292	20,285	1,407,145	1,631,712	1,631,712	0
Trans World	204,481	15,104	4,269	5,429	417,204	646,487	646,487	0
<b>NAVY/ARMY</b>								
Boeing	1,390,405	30,154	10,438	17,329	407,754	1,786,100	1,644,237	141,863
Trans World	407,327	1,743		22,412	13,112	443,594	443,594	0
<b>CARDINAL</b>								
American	1,390,405	30,154	10,438	17,329	407,754	1,786,100	1,644,237	141,863
Boeing	416,000	8,109	5,023	13,206	139,143	571,481	534,770	36,711
Capital	352,010	5,147	3,564	5,643	158,981	635,345	606,075	29,270
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Capital	165,611	27,479	11,292	20,285	1,407,145	1,631,712	1,631,712	0
Trans World	204,481	15,104	4,269	5,429	417,204	646,487	646,487	0
<b>ALASKA</b>								
American	1,390,405	30,154	10,438	17,329	407,754	1,786,100	1,644,237	141,863
Boeing	416,000	8,109	5,023	13,206	139,143	571,481	534,770	36,711
Capital	352,010	5,147	3,564	5,643	158,981	635,345	606,075	29,270
Continental	314,186	37,318	8,100	43,123	129,441	512,148	471,242	40,906
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Northwest	830,141	23,957	17,331	31,469	147,414	1,029,312	1,008,809	120,503
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Western	323,750	15,313	15,313	43,220	43,220	432,816	432,816	0
Boeing	691,487	25,114	15,364	10,419	1,478,813	1,731,183	1,731,183	0
Capital	165,611	27,479	11,292	20,285	1,407,145	1,631,712	1,631,712	0
Trans World	204,481	15,104	4,269	5,429	417,204	646,487	646,487	0

\*Not available.

Compiled by Airlines Week from data reported in the Civil Aeronautics Board.



## READY FOR ACTION



DOUGLAS B-66, ALL-WEATHER TACTICAL BOMBER TAKES OFF FOR PRACTICE MISSION

### B-66, Protected by General Electric Automatic, Electronic Tail Armament Gives TAC Greater Mobility, Flexibility

Built for high-speed interception and reconnaissance, the Douglas B-66 is the latest addition to the Tactical Air Command's offensive power. General Electric's MD-1, electronic tail armament system provides an accurate, defensive punch to help the all-weather bomber accomplish its mission.

To ensure optimum integration of components and continuously high performance of the equipment in the field, the system is completely assembled and tested at the factory and followed through operational usage by highly skilled General Electric technicians. General Electric's complete, follow-through service helps keep the B-66 tail defense system truly "ready for action"—ready to counter with speed, precision, and reliability.

**ENGINEERS:** Expanding electronic bomber defense projects at G-E are creating opportunities for you. Contact G. E. info, Aircraft Products Department, General Electric Company, Johnson City, N.Y.

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**



**GENERAL ELECTRIC ARMAMENT SYSTEM** gives B-66 power electronic warning of an intruder, split-second analysis and positioning of guns with correct lead for a kill.

**OVER-ALL CAPABILITY OF G.E.'s  
AIRCRAFT PRODUCTS DEPARTMENT  
ASSURES READY-FOR-ACTION SYSTEMS**



**COMPLETE TAIL TURRET PACKAGE**, made up of G-E radar computer and gun turret, is assembled for shipment to Douglas for incorporation into B-66 systems.



**WIND TESTING** of mounted tail turret in wind range assures delivery of "combat ready" defense system for the bomber's first flight.



**SERVICE ENGINEERS** help Air Force attain maximum armament maintenance standards, provide G-E designs with field data to speed improvements.

# AERONAUTICAL ENGINEERING

## Boundary Layer Control Aids Helicopters

By Robert H. Cochrane

Boundary layer control can extend the high speed limits of helicopters that has been proven by CH-1 flight tests, according to S. H. Hinton, engineer for Cassin Aircraft Co., Helicopter Division.

Snaking air through slots in a modified CH-1's rotor verified that a helicopter was able to fly at least 15% faster than its ordinary upper speed stall limit. The roughly 15 mph gain was at only 7% cost in weight for the boundary layer control (BLC) system. Power limitations and drag penalties at the test vehicle point caused Cassin from finding out how far the maximum air tip speed could be carried out.

The gain would have been even greater in a helicopter designed to take advantage of the BLC, Hinton told a recent American Helicopter Society Meeting.

### Problems

As a helicopter moves faster and faster into forward flight, the forward winging rotor finds itself being into the air faster. But the forward winging rotor on the opposite side finds itself going through the air slower. To counteract this addition and subtraction of flow, on the opposite sides of the rotor, helicopters have been feathering out or feathering the angle of attack on the advancing side and increasing the angle of attack on the retreating side.

This angle of attack difference between the advancing and retreating blades must increase as the forward speed increases. As some forward speed the retreating blade is forced into an angle of attack exceeding the critical stall angle of the blade and the blades progressively stall as they go around into the retreating side. When forward, as might be expected, more power is required, requires more horsepower and can even result in loss of control for the helicopter.

### BLC Solution

Cassin defined the retreating blade stall at high angle of attack by sucking off the low speed boundary layer at it focused on the upper surface of the rotor before it could build and separate, thereby separation of air being swept away with itself. They did this by sweeping the air out of a hollow rotor blade with a long slot on the upper blade surface.

When the suction slots were used on



THE BLC test rotor blades and a hollow boundary layer control trailing surface.

the 26-inch, 2,600 lb., 160 hp. Cassin CH-1 helicopter, the 190 ft., 50 hp. section system enabled the CH-1 flying at 1,000 ft. to maintain its top speed from 87 to 100 mph without stalling.

Even at the upper limit to which the test helicopter's powerplant would peak at, the amount of stall drag pulled was only 15% removed from the trailing edge. And since Cassin has defined stall as 90% of the rotor chord separated (because at 50% the lift falls off sharply), it was felt that a CH-1 with a better high-speed rotor than the test vehicle could have pushed further up to speed without stalls.

### Test Hardware

Two test vehicles were used. One a Cassin CH-1 helicopter with the special BLC rotor blades and pumping system and the other a regular CH-1 but with similar rotor blades (though unaltered) for comparison.

The CH-1 was chosen not only because it was available to the Cassin engineers but because it was able to get up to an altitude where forward speed is normally considered to be the major obstacle of the blades to stall. But BLC could be demonstrated without going to a helicopter of special design.

The dotted and control blades were both manufactured by the Avco Aircraft Co., Clinton Heights, Pa. They were constructed with an aluminum honeycomb replacing the standard CH-1 blades' corrugated aluminum substructure. The BLC dotted pair had slots made up of 1 in. long sections with a 1/2 in. channel bridge between, placed at 75% chord. The dot itself appears to have been made .015 inch. They started half way out along the rotor and stopped at 34 inches because the rotor 4% of the blade was found not to be contributing significantly to the BLC effectiveness.

The air was sucked from the hollow rotor blade over a flexible length of hose into the blade roots and by a Cassin-designed lightweight vacuum line feed displacement pump. Both ends of the system were valved off so that those could be shut back flow. On the rotor end, rubber gaskets prevented the air tripping force along the rotating blades.

from drawing air out during the off portion of the cycling valve. A large hose at the BLC pump controlled draw prevented back flow when the pump was not engaged.

Hinton pointed out that the control force which might be thought to be lost blowing BLC, rather than sucking BLC, actually apparently helps both because it subtracts momentum in the case of sucking BLC and adds the pump in the case of blowing BLC.

The rotary coupling which transmitted the flow from the rotating rotor to the stator, duct leading down to the pump, performed the dual function of not only acting as a rotary coupling but as a cycling valve as well. It was made to pull air from the rotor only during their forward sweep from 254 to 326 degrees azimuth.

As mentioned, the pump was designed by Cassin Hinton and that after developing that a feed displacement rotor was pump was best for the job that found that nothing but heavy duty industrial steel was available. They therefore designed a 1,030 cu. ft. per min., 2.3 compression ratio, 17 in. dia.,

27.5 in. long rotary vane pump which weighed out 144 lbs. In air photoelastic stress tests sustained at 1,500 rpm. The entire BLC system weighed 190 lbs. but took 50 gross wt. hp. to do 181 act by of pumping.

### Flight Tests

Cassin made 34 test flights at 10,000 ft. The basic test data was obtained by motion picture flow indicating shades of tints given to the rotor blades. The motion picture cameras were strung on top of the rotor hub so that they followed the blades around and also traced a continuous picture of what the BLC was doing to the flow over the rotor blades. Depending on the amount of suction of the test, Cassin was able to determine how far the stall separation had progressed from the trailing edge.

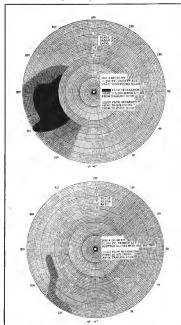
Although this sounds as directed specifically to the BLC, the test was to define the retreating blade stall on forward flight, Hinton said that other types of BLC could be designed for other use on helicopters. For example, the effect could be used to improve the laminar boundary layer for drag reduction to reduce power requirements (this might be attractive on flying crosses) or with trailing edge slots as a primary means of helicopter flight control.

Cassin worked into their BLC program with model wind tunnel tests in the 4 ft. non-return tunnel at the University of Wichita. An oscillating drive was used to cycle the angle of attack of the rotor in the two-dimensional test setup to partially simulate helicopter forward flight. Meanwhile, a photoelastic light source stepped into the stall and an oscilloscope interpreters were given oscillograph recordings of the pressure against the rotor vanes.

During the wind tunnel an experiment, blowing BLC was chosen because of the large gathering moment it introduced. Power suction was not out of the rotor was also chosen because it was felt that the low finger strength of porous materials would give "formable" structural problems.

The NACA tests were run at 10,000 ft., 61-015 and 61-115. Hinton's group found that the large nose radius of the NACA 61-015 rotor section was the most significant to the stall-lifting effect. So far in the location was concerned, though the clockwise position did not affect the BLC efficiency, it did affect the pumping power-reducing the power input in it moved forward to the leading edge.

Skorke's also studying helicopter BLC. What benefits BLC could have in extending the high speed of use of Sikorski's advanced fast helicopters will be interesting to see.



LOOKING DOWN on the planform of the rotor swept out by the rotor, these photos show the degree to which the flow separated at each helicopter's maximum speed. Where the upper row BLC rotor had full stall (black) only some 100 degrees azimuth, the BLC rotor showed only grey areas of less than 90% separation.



A PUMP installed on the rotor flow path, the flow through gap and flexible duct and a rotor valve into the blades.



HALF OF one head rotor vanes with rotor to cycle boundary layer suction flow from blades.



**NEGATIVE** for projection of drawings are mounted in carrier that slide into position, reversibly, to be collapsed by Macosmair Cassette. Contact panel is capable of being expanded to the second half of a second.

## Service Offers Larger Negative For Better Drawing Reproduction

Engineering drawings are reduced to 165 mm. for air storage and enlarged again with better quality than the original by a recently started service which will soon be available in 40 major cities in the continent and also in Europe. The service will be available to users whose volume of drawings would not justify purchase of equipment for comparable work.

TWA has placed an order with the new service, operated by Knefel & Esner Co., to reduce all 18,000 engineering drawings for their new Lockheed 369F Super Star Constellation. Storage space for the negatives will be 15 sq. ft. Reproduction would require 952 sq. ft. Standard prices are being considered by TWA for their Boeing 707 and Convair 440 jet liners.

### High Cost

Because of the high cost of equipment for the 801 mm. "Micromatic" technique, K&E officials expect that users will prefer to use the service rather than buy and operate their own equipment.

The 165 mm. technique is believed to be a better compromise between requirements of minimum storage space and high quality blow up the photo 15 mm. microfilm and 70 mm. photo graphic reduction systems. Based upon the 10 diameter limit on efficient photo negative reduction generally accepted by the experts the 165 mm. system can

maintain the quality of a larger drawing than the small film system. Reductions of greater than 10 diameters bring line thickness too close to film grain and will result in a grainy blow up and loss of detail.



**Mitsubishi F-86s**

North American F-86s are assembled by Japan's Mitsubishi Heavy Industries with engines and parts obtained from the United States. Mitsubishi is expected to assemble 300 F-86s by July 1958, and in due time to manufacture its own jets.

For drawings up to 56 x 54 inches in size, the new service can actually improve the quality of a reproduced form 30% to as much as 75% over the original. This is possible because film, camera, projector and enlarger have been specifically designed for line reproduction rather than adapted from systems intended for tone reproduction. Another factor in quality improvement has been the development of cost reduction methods made possible by the service approach. The optical design chosen here has been chosen but once before commercially—imperfect when based on a product sales approach.

Specialized photography yields quality not to be had by non-photographic methods because these generally rely on the passage of light through the original. This picks up subsurface fibers and surface distortions and dirt on both sides of the original. Photography by means of only selected light sources all but the flaws on the first surface and most of those on the second are cut by using a projection method which is capable of picking up only a small range of tones. Also, other aberrations like in a glass are darker and sharper than lines in a point tracing.

Negative is made. Record of Standards requirements for archival quality, which is described in detail without exception for 180 years or more. For photo negative this requires holding the camera of developer instead in the camera to less than .005 mm. per square inch.

The 165 mm. technique was devel-



*Judge  
a Product  
by  
its Users*

Proud achievement of advanced design and engineering is Lockheed's F-104A, world's fastest combat plane. Among the components contributing to "years ahead" performance are Aeroquip 601 Lightweight Engine Block and "Wetite gun" fittings used for fuel, oil and pneumatic lines.

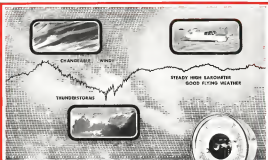


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These weather items prepared in consultation with the United States Weather Bureau

# BAROMETRIC FORECASTING



Barograph makes a continuous record of barometric readings that control goods. Large changes are indicators of weather shifts.

Correct interpretation of barometric behavior can be a valuable aid in forecasting weather. As pilots know, a falling barometer indicates the approach of a low pressure system with associated bad weather. High winds can generally be expected when barometric rises or falls rapidly. Upturns indicate a weakness and improving weather.

*Rise as wind* However, that no pressure normally goes up or down with daily turnover of the earth. Thus, at maximum pressure is higher at around 10 A.M. and 10 P.M. Lowest at around 2 A.M. and 2 P.M. So a falling barometer between 10 A.M. and 2 P.M. does not necessarily indicate approach of a storm.

Around barometer can be used to make good of a general forecast of most of readings it kept. Best find minimum level. Especially in long run of pressure changes. Grade up will show if conditions rise up or down.

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## Rolls-Royce Avon

Rolls-Royce Avon RA.29 shown here on assembly line at Derby, England, is scheduled for use on the de Havilland Comet 4 and 5A. Specially designed for civil motor operations, engine has static thrust of 10,500 lb. and weighs 5,341 lb. Because of low flame temperatures Avon RA.29 gives low fuel consumption. Engine is assembled in vertical position on platform which can be moved and lowered horizontally. Final stage of engine is placed on platform first and is assembly goes on it is lowered into pit for convenience of adjustment and wiring.

opened by Micrometric, Inc. of Kansas City, said K & S. Space engine required, while greater than 500 lb. for 55 mm. reservation, is still only 4% of that needed for full-size designs.

It provides as one means of changing size. Correct parts can be produced which are useful for design studies and in some cases for reference. Reference parts can also be made to quarter or half size. Service men will be supplied payables so they can gain from inspection at their own convenience. Because of the cost problems there will not only the same economies in the big projects in the service industry but will be a consistent source of reference parts and transparencies. As a new service, table top views will be offered which will project an enlarged range on a translucent screen for reference purposes. Also available is a viewing table which permits making changes on a tracing from the full size projected range.

Part of the service will be based on number and quality of originals. Improved Air Speed Indicator Suggested. An improved air speed indicator would find pilots of the need to colorize leading speed for safety during

leading heights created by the high proportion of disposable fuel weight to maximum gross weight in some jets. Fuel weight may be 40% of maximum gross and its consumption rate constant for as much as a 50 lb. reduction in leading speed. Manufacturers may come diagrams considering or still in the approach.

The improvement was suggested by Squadron Leader B. G. Ghosh, Indian Air Force, an associate fellow of the Royal Aeronautical Society and the Aeronautical Society of India. No manufacturers are known to be considering it.

The new indicator incorporates a fuel gauge line with fuel quantity pointer sent in the appropriate no. record display. A shutter with a window or a handle marked pointer is manually adjusted or driven by the fuel quantity indicating system and varies down both sides as fuel is consumed.

For aircraft in which maximum payload is large part of gross weight, the concrete fuel tank and it would in suitable increments to correct leading speed reduction for payload variations. The correction is made manually. For a bomber the only conditions likely are empty or with a full load.

In this case, a two position adjustment is suggested.

## FIRST RESEARCH REACTOR!



FOR INDUSTRIAL DEVELOPMENT

Pioneering use of atomic energy has become a contributing factor to the development of the first nuclear reactor designed for service industrial research by Atomics International, a division of North American Aviation Research. Welding components for Atomics International on this tremendous achievement and is proud to be a subcontractor to such a first world leading research.

Research Welding's unparalleled skills in metal fabrication of tanks, boilers and components are available for experimental and development work in the construction of reactors, steam generators and heat exchangers. Let us outline your problem. Call or write today for information. Also, when needed, give you under construction with great new design facilities for the atomic energy industry of 1959 and beyond.



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## AIRBORNE FINGERPRINTS

— new air traffic safety by Stewart-Warner Electronics

Now, the new Stewart-Warner Electronics Airborne Safety Beacon makes it possible for every plane in the air to carry identification as positive as your own fingerprints. Stewart-Warner Electronics, the pioneer and builder of the first airborne safety beacons, which were tested by the Air Navigation Development Board and CAA, now offers airborne and other aircraft owners automatic identification for greater air traffic safety.

The new beacon combines all the reliability and long-life factors of airborne military equipment supplied by Stewart-Warner Electronics to the services since 1942. This rugged equipment incorporates ARENC tubes and is designed to meet specifically characteristics No. 532-A.

CAA is now planning to install interrogators on ASTR radar at all major air terminals to improve air safety. Be sure you take advantage of this program by installing an S-W Electronics Air Safety Beacon. Write today for full details from our Civil Aviation Department 14, Stewart-Warner Electronics, 1300 North Kottler Avenue, Chicago 51, Illinois.

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## PRODUCTION

### Beryllium Offers High Structural Promise

By Irving Stone

Los Angeles-Jahromi lightweight and strength of beryllium may permit design reduction in surface weight and shield undesirable equipment in aircraft performance.

An extensive overall study of the characteristics of beryllium indicates that the metal offers high promise as an aircraft and missile structural material. For example, here are some advantages seen for a transport plane:

- Possible stiffness weight reduction of about 50% in comparison with aluminum alloy structures. A beryllium structure would weigh about 40-60% of the conventional metal structure at room temperature, and still show a significant weight advantage up to approximately 1,000°F.
- Range increase of about 40%.
- Reduced air drag that the metal's "smoothness" in an aircraft might mean as high as 51,000 per pound.

#### Brittleness

In the line of the promising outlook, there are hurdles to be overcome. Chief among these is beryllium's brittleness and the fact that its advantages of the metal cannot be realized without improvement in that characteristic. However, line of research to attack the problem of beryllium have been proposed.

Other deterrents include the metal's high cost, possible toxicity, and toxicity, but these appear less serious.

Evaluation of beryllium for aircraft structures was performed by William R. Mada, Dr. George A. Hoffert, and other scientists of The RAND Corp., Santa Monica, Calif., a non-profit organization conducting research for USAF.

#### Improvement Sought

A study of the RAND study was presented by Dr. Hoffert at a meeting of the Los Angeles section of the Institute of the Aeronautical Sciences. Today may be more than a year, the study originated in a search for ways to improve wing performance of aircraft. RAND's work focused on air materials. Metallic elements were considered for which adequate information existed on mechanical properties. A liquid screening was developed adding element stress analysis with the weight of structures that might be made of the material. This screening showed that there are many metallic elements with lower stress numbers than the

normal, today's conventional search metal, and of these chromium beryllium makes the lightest structure.

#### Low Density

Properties of beryllium having it show other metal for structural use range from a very low density (one in magnesium) and very high modulus of elasticity (14 times that of steel) to a great potential strength, it is reported. One qualification is that today's beryllium is not ductile enough for use areas to which it might be put.

Strength and modulus of elasticity of the metal at elevated temperatures, as contained by the study, are the highest values exhibited by a powder extruded beryllium produced by Beryllium Co. in 1955. It should be noted, Hoffert points out, that considerable variation in strength is typical of the metal, because of sensitivity to the method of production.

Continuing growth of the strength of metals in general within the past few years has been paralleled by the improvement in the strength of beryllium in the last decade, Hoffert points out.

This trend has caused much speculation that future alloys of beryllium may have higher strength than the best present metal. On the other hand, he says in predicting the elongation of the metal in the future, it is uncertain whether the elongations obtained at present can be significantly improved in the structural evaluation of beryllium, it is compared with 7178S-T6 aluminum alloy, 17-17PH steel and 6 Al-4V titanium alloy on a weight basis for equal strength structures, considering room and elevated temperature loading over a range of temperatures.

These comparisons suggest that the beryllium has sufficient ductility for use in airplane structures and that the best beryllium today will be representative of the best beryllium alloys available in the future.

#### Weight-Strength Ratio

Comparing structural elements designed for tension loads, a weight-strength ratio comparison with conventional metal shows that a beryllium structure would weigh about 40-60% of the conventional metal structure at room temperature. Hoffert says Beryllium would still show a significant weight advantage up to temperatures of approximately 1,000°F.

Fatigue and creep properties were not



RELATIVE weight of tension elements at various temperatures.



RELATIVE weight of short-tension pins at various temperatures.



TAKEOFF weight vs. design range for tension and compression transport planes.



BREAK over stress of beryllium vs. range in transport airplanes.

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## Beryllium Properties

Mechanical properties reported for Beryllium include density, 460 lb per cu in.; modulus of elasticity, 44 million psi at 70°F, 43 million psi at 500°F, and 36 million psi at 1,200°F; yield tensile strength, 251,000 psi at 70°F, 65,000 psi at 500°F, and 20,000 psi at 1,200°F; ultimate tensile strength, 135,000 psi at 70°F, 55,000 psi at 500°F, and 11,500 psi at 1,200°F; elongation, 14.5% at 70°F, 3.14% at 500°F, 16.14% at 1000°F, and 10.34% at 1,200°F.

included in the comparison because sufficient data on these characteristics of beryllium were not available.

Considering that welded elements designed by beryllium means, the methods of comparison are somewhat more complex than for the case of single factors. In comparing weight efficiencies of different materials used in this welded structures, the most important parameters to characteristics are density and modulus of elasticity. Beryllium is unique in these respects; it is denser because it has a low density (180) and a high modulus of elasticity (44 million psi).

## Complete Comparison

However, a complete comparison must also consider the elastic behavior of materials, as well as the elastic behavior, it is pointed out. The methods used for this comparison were based on principles of maximum weight design as developed by the structure group at RAND.

The analysis showed that a firm welded beryllium-beryllium structure which would fail by buckling would weigh about 92% that of a structure of conventional metals up to two pressures of about 1,000 psi.

Thus, it is claimed that with respect to weight and comparison elements, beryllium dominates the field of aircraft structural metals in offering for lighter structures. Although beryllium could be substituted hypothetically for other metals in about ten times the thickness of a modern transport, that still means about one-third of the weight where beryllium could not be used. On this basis it is calculated that a transport aircraft utilizing beryllium where applicable would weigh about 52% as much as a conventional aluminum structure.

## Hypothetical Jet

Hoffman stated that the study had considered hypothetical turbojet engines and aircraft under the capability to get turbojets being cleared for commercial use. Characteristics included design payload of 35,000 lb, Mach 35

Production News from **Bridgport** Thermostat



## FROM THIS ALL-NEW PLANT— MORE AND BETTER BELLOWS

On its new 15-acre site at Milford, Conn., Bridgport Thermostat now has 150,000 square feet of modern shop production facilities to assure quick delivery of all the bellows or bellows assemblies you need...at the lowest possible cost. A temperature and humidity controlled room for shaping bellows materials is only one of the many ways in which the ultra-modern plant promises you bellows assemblies of consistently high quality.

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design cross, 40,000 ft. initial cross should, loading diameter 14.5 ft., length 125 ft., interpitch 50 deg. The beryllium plate is assumed to be made of metal with highest strength obtained in the aluminum body and with clamping and other properties sufficient for structural use but not yet achieved.

With the structural weight of the beryllium structure estimated to be 52 tons the corresponding weight of the aluminum plate, the beryllium design offers an increase in fuel weight equal to about half the aluminum structural weight. This additional fuel extends the range of the beryllium transport about 40% beyond that of the

aluminum counterpart of equal takeoff weight.

Effect on range extension is shown in the graph (p. 57).

One criticism of range through use of beryllium is obtained with a material of high cost. Hoffman reveals that this enabled cost of a full scale beryllium structure of the fabric, after an intensive development program, is actually estimated to be \$150 to \$190 per pound, whereas aluminum is usually figured at \$20 to \$40 per pound installed.

While this cost discrepancy seems excessive it could be offset by operating economies. An operational trade-

over value for beryllium was compared. This value may be considered as the "worthiness" of beryllium to the operator-like amount he would be willing to pay for a beryllium structure to achieve maximum in operation over that of an aluminum plane. The study showed that this "worthiness" was undoubtedly above the estimated cost, installed cost for beryllium and compared with range capability.

#### One-for-Two Use

Since two pounds of beryllium will do the work of two pounds of aluminum, the "worthiness" should be equivalent to saving one pound of structural weight throughout the life of the airplane, Hoffman points out. Estimates turn on the value of saving a pound of weight, but have ranged as high as \$2,000, it is claimed.

The importance of the beryllium problem associated with beryllium cannot be over-emphasized, Hoffman declares since some of the metal's advantages could be utilized without a reduction in the demand. It is uncertain whether the benefits of the present metal can be significantly improved, and it is not clear that the beryllium will qualify as an acceptable structural material.

Hoffman explains that if the beryllium crystal under tension loads exhibits a fair amount of ductility in some directions but behaves as a brittle corner in others. This results in low values of elongations of the metal. Some success has been achieved in turning the ductility by use of powder metallurgy techniques. The powder metal, in comparison, etched and annealed into sheets. These sheets have 16-19% elongation under normal loading in the plane of rolling, and maintain elongation perpendicular to it, he says. There has been no reduction of this material for aircraft structures.

#### Avenues of Research

Maximizing possible revenues of research Hoffman sees that reduction of beryllium use may result from higher purity metal, better knowledge of the metallurgy, discovery of beneficial alloying additions, or from better production techniques.

Structural evaluation could consist of tests of the best metal for tension and compression stress-strain curves (tension and bending), static tests for panel shear, fatigue tests, short time and creep tests at elevated temperatures, etc. Realizing structural elements could be assembled and tested in loading.

A research research effort in the beryllium problem, part of a larger program to make beryllium available for various purposes, has been carried on by the Atomic Energy Commission for



Transcendental's VTOL

Transcendental Aircraft Corp. has begun flight studies of its Model 2 convertible on test again at its Glensville, Pa. plant. Model 2, built under USAF contract is expected to fly early next year. It is a high wing monoplane with three variable wings at each wing tip. When action was taken forward it becomes a conventional airplane with a cruising speed of over 140 mph with 250 hp engines. Earlier Model 1-G made 100 successful flights during 1954 and 1955. TAC claim Model 1-G was converted up to 9000-9000' in one hour and 1955 on orders. Company says this is maximum conversion in the art of tilting entire aircraft bodies.

Grinding and machining must be performed under controlled conditions. However, massive forms of the material are almost limitless because so much of the metal rolls off to be of any consequence. Structural shapes, therefore, will be able to be developed with unprecedented bands.

#### PRODUCTION BRIEFING

Moore Development Co., Tarrytown, Calif., is a new firm which founder Joseph H. Moore will specialize in experimental and prototype fabrication of aircraft components and conduct initial testing for major aircraft manufacturers. Moore is engaged as head of the experimental department of Pacific Aircraft Corp. to found his new company.

Nacisco Products, San Diego, Calif., is the result of the merger of two small San Diego machine shops plus engineering talent from two of the largest West Coast firms, General and Boeing. The two firms which provide the backbone for Hercules and National City Machine Co. and San Diego Machine Co. R. G. Greenhouse, W. Don Howell and J. L. Shumway, chief engineers, general manager and research planning respectively, are from Canine. James H. Elliot, design engineer, is from Boeing. The 45

men firm recently is now expanding an extensive tool-die shop and has a fast response temperature transducer. Plans are being made for rapid expansion to over 100 employees. Work will be in precision aircraft tooling as well as advanced instrumentation.

Amesbury Silver Co., Inc., Fitchburg 54, N. Y., a precision rolling of metal bars of 100 and 400 series stainless steel down to .005 in. bar thickness coils and other stock. Claiming sales volume of about \$500,000 in 1954, the company will undertake expenditures from the proceeds to several lines.

National Bureau of Standards says it has successfully demonstrated electronic protective coatings as technique for first forming a reference thermocouple, electrophysiology with chronometer and then heat treating in 1955.



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working material gives a visible proof that a part to which it has been applied has been successfully relieved of hydrogen embrittlement in baking.

Goldard & Goldard Co., Detroit 27, Mich., announces that it has a complete new series of flat-faced blade shag



gears for both-closing action for use on a standard and offset light match. They range from 1/8 in. to 7 in. wide and from 4 in. to 35 in. dia.

Menzies of Whitlock Co. aircraft fuel pump was made of methylacrylate diethylene glycol in an injection molded design the perforated steel aluminum



shells. Called Nylonite "CK," the material is used in the motor, Nylonite Pulverizer Products, Reading, Pa. To allow the pump to operate against 1,500 psi, the motor is as long as 100 in.

Joseph T. Ryan & Son, steel distributor of Chicago, claims that its use setting of stainless steel in a special steel cutting machine used in Ryan's made in the 100-Men Machine Co. Kanawha, Tenn. It can handle steel flat plates up to 12 in. by 15 ft.

Tagged Air Products Corp., Livestock, Calif. received 540,000 lb of E-102A subcarriers from General Division, General Division Corp. Tagged Air will produce sculptured structural components such as wing skins and doors.

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## Mobile gas turbine power cart takes only 30 seconds to start giant B-52 jet engines

The AirResearch MA-1A mobile gas turbine compressor, the first unit of its kind qualified by the Air Force to meet the unprecedented 350 horsepower of the Strategic Air Command, is now in volume production at the AirResearch Manufacturing Division of Phoenix.

Extremely self-contained, it furnishes a completely autonomous source of compressed air power at the point of use. All components, parts and accessories

are included in the fully enclosed weather-proofed trailer. The mobile unit weighs only 1150 pounds and may be controlled either from the instrument panel or from a remote control panel. It will start and maintain continuous operation at ambient temperatures ranging from -60°F to 120°F, together with the other extremes of environmental conditions encountered at airports throughout the world.

The two-stage gas turbine compressor may be recovered easily from its trailer, has no air intake valves or as a stationary unit. It has an output capacity of 120 pounds per minute flow at 50 psi... enough power to start all ground service needs for a medium airplane. Write to our Sales Planning Department for further information on this product. Qualified engineers are needed now. Write for information.

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## AVIONICS



**ASTRATAC**, new system automatically tests various components, sorts them according to value, records its findings, then plots them up in bar-graph (histogram) form.

## New Test System May Aid Avionics Firms Meet New Reliability Criteria

By Philip J. Klaus

New York—Astratrac, a new automatic system for production-line testing, sorting, data recording and quality control analysis of avionics components, can speed such operations by a factor of 10 to 20.

The new system could aid avionics component manufacturers in meeting the new 10% reliability criteria which the Defense Department plans to include in future avionics production contracts (AVR May 12, p. 24).

Astratrac, described here during the recent International Automation Exposition, was developed by Electronic Control Systems, Inc., an affiliate of Stouffer-Griffin, which is a subsidiary of General Dynamics Corp.

The present system can test individual type components (resistors, diodes) at a rate of more than 3,600 per hour, automatically sort them into as many as 16 different categories depending upon their measured values, ECS says. Test results simultaneously are recorded on punched tape, then analyzed and plotted as a 16-interval bar-graph (histogram) which resembles a distribution curve of the batch of components tested.

ECS is now developing an auxiliary

computer which will automatically calculate the average and standard deviation and graphically present such information, ECS Engineers Eugene Hoo reported.

Although the Astratrac system principles can be applied to the processing of a variety of different components, including non-avionic, the present system consists of the following:

• **Component Handler-Sorter**, that has finger feed that permits bulk loading of available components to minimize loading time. Device is easily adapted to accommodate components with different body lengths and diameters.

Components are transported automatically into test position, tested, then deposited



**HISTOGRAM** shows number of components with different values in batch tested.



**KEYBOARD** interface for use with manual testing will record data on tape for plotting.



**COMPONENTS** dropped into hoppers of the device are tested and automatically sorted.

into one of 16 bins according to their measured values.

• **Tester Recorder**. This device controls the component test conditions, converts resultant voltage on a d.c. digital voltmeter. Operator-selected range of values is divided into 16 equal sub-ranges, corresponding to 16 bins in Component Handler-Sorter. The Tester Recorder provides tape after each component is tested to record into which of 16 sub-ranges the particular component value falls. A relay matrix also operates automatically to cause the Component Handler-Sorter to deposit the component into the appropriate bin.

• **Analyzer-Recorder**. The punched tape record, when fed into the device, causes it to tabulate each of the components in one of 16 registers, each corresponding to a different component value. When the entire tape has been read, or at an intermediate point, the operator can cause the analyzer to plot out a bar-graph (histogram) of the batch by pushing a button. The histogram shows how many components within the batch fall into each of the 16 different value sub-ranges.

With conventional manual test procedures, where the operator must make the decisions, record the data, and perform the necessary sorting, the process takes an average of 20 seconds per component, Hoo says. Astratrac does the job in one second.

To prepare test data for 600 components into a form for plotting a histogram, and making the actual plot, may

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 <p><b>200 TRIMMER</b> —Dual Potentiometer</p> <p>Two rugged, electrically independent, and yet electrically interconvertible by wire adjustment.</p>	 <p><b>160 TRIMPOT</b> —High Temperature</p> <p>Operates at 175°C. High stability rating. 0.1 watt at 50°C.</p>	 <p><b>250 TRIMPOT</b> —Memory pot</p> <p>Conservatively rated, only 0.001 watt. 0.1% drift/decade for 100,000 cycles.</p>



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take more than an hour. Hao says when Automatic can do the task in less than three minutes.

To provide some of this advantage to manufacturers who do not wish to invest in fully automatic test equipment, ECS has come up with a Keyboard Classifier. This device, resembling a desk calculator, enables a test station operator to record individual component test readings on a keyboard, which automatically provides a permanent tape record. This type can then be fed into the Analytic Recorder for automatic classification and plotting of a histogram.

Electronic Control System, Inc. is located at 2135 Westwood Blvd., Los Angeles 25, Calif.

## NAA Develops TV Guntery Instruction

A gunnery instruction monitor has been developed by North American Aviation's Columbia Division to enable instructors to give corrective advice to students immediately when errors are made during gunnery paces.

Known as NAGIN, the system uses a closed-loop transmission television circuit. Student pilot's target and gun sight picture are viewed by a small TV camera and sent by instructor on a 3 in. video signal to the instructor's panel ahead. Without the system, the instructor's effort had to be assumed after viewing gun camera film.

The new system weighs less than 50 lb. and is controlled with little effort.

## Los Alamos in Line For Speed Computer

A new super-speed digital computer, capable of operating 100 to 200 times faster than any comparable general-purpose computer available today, will be developed by International Business Machines Corp. for installation at the Los Alamos Scientific Laboratory.

The new computer, to be called STRETCH, will consist of a group of sub-coordinated machines, each performing one fixed function. One such device, called a "bookkeeping computer" will convert data into a usable code before it is introduced into the control computer. This will permit the machine's more intricate unit to operate almost continuously, in contrast to present computers.

The machine will be able to accept information from several input sources simultaneously and act upon it in parallel. IBM says programming and debugging data will pass through an electronic multiplex unit which will route it to the correct location.

STRETCH will be able to multiply

## Semiconductor Business

Semiconductor industry business will increase 300% to next five years, from present 500 million dollar figure, according to Hughes Aircraft Co. estimates. The figure includes diodes, resistors and transistors. Hughes reveals that it now produces about 20% of the industry's total semiconductor output with current sales of about \$12 million. Company also declares its 1956 sales of semiconductor materials, for control and other remote applications will exceed \$100 million, about 10% above its 1955 sales. Building it over \$300 million, HAV says.

two 12 to 15 digit numbers at the rate of 700,000 per second and add two such numbers at a rate of two million per second. A complex nuclear problem involving up to 100 billion mathematical operations that might keep an IBM 701 at 75% busy for six months, can be solved by the new machine in about one day, the company says.

An interesting sidelight is the fact that IBM plans to use its 704 computer to analyze the potential performance, and controls for its new STRETCH machine.

## Expansions, Changes In Avionics Industry

Avionics Electric Products, Inc. will build a multi-million dollar research and development center in Anaheim, N. Y., for its Electronic Systems Division to house activities now located at the firm's nearby Buffalo plant.

Construction of the new 100,000-sq-ft facility will begin only next year on 15-acre site near the Buffalo Municipal Airport.

Shelton expects to employ approximately 500 at the new laboratory when it goes into operation next year. Company also will build new 10,000-sq-ft addition to its Electronics Division headquarters plant at Walnut Man, scheduled for completion next July.

Other recently announced expansions and changes in the avionics industry include:

- General Electric has formed new Communications Products Dept. to handle GE's mobile radio, microwave radio relay, and other communication systems. New department will be headed by Herman Van Allen Jr.
- Spaul Engineering, Inc., Fairfield, N. J., is constructing a new 65,000-sq-ft facility, the same size as the firm's planned expansion program.
- Universal Match Corp., St. Louis, Mo., has acquired Diversicon Research America, Seattle, engaged in the de-



Chinese Vought Corsair on flight deck of the U.S.S. Forrestal. The Navy recently set a new U.S. speed record of 101.3 m.p.h. with the Corsair in setting the Thompson Trophy event.

## Crusader's dark tail—sign of a bright future

• Notice how the fuselage gets darker as your eyes look here to left?

The dark area identifies the use of titanium for a tail cone that covers the jet engine. Titanium is the only light metal that can stand the intense heat. This titanium alloy is used for the entire tail cone, including outer skin and inner bulkheads and support members. The use of hundreds of pounds of titanium alloy here saves precious weight, helps put the Crusader in the over-1000-mph-per-hour class.

With such new or improved aircraft design more titanium from Mallory-Sharon is used... this remarkable



Inspection of tail cone assembly. It is an example of consistent titanium quality. Mallory-Sharon supplies what is required in fabrication.

metal is a dependable, uniform material. For example, Mallory-Sharon certifies the uniformity of titanium mechanical properties and guarantees optimum machinability. For optimum use depend upon, call Mallory-Sharon for your requirements in titanium.

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The pills are described like viruses and a further point: the pills travel through the air through sweat, tears, blood, spit, urine, feces, to infect others and destroy them.



**As** and **at** are used in many similar positions and both frequently have several meanings of their own. In the following examples, *at* is always used.



**She** explains with Spina authority to increase the efficiency of formulating or revisiting high-level goals. In short, it gives you more time, energy and ideas to achieve goals.



**144** steel bolts subjected to shear results caused by varying longitudinal movement spread across the displacement of inner and outer shells. *Journal of Bridge Engineering*, 1999, 4, 1, 1-10.

**1** **WIDIA TRIMMING SAVINGS.** With approved efficiency of WIDIA, long-life 1/2" borers are up to 3 times as efficient as hand-operated, because you're in no more danger. This permits more cutting activity with less time on the physical strain. Thanks to a new tie-on end cap.

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**2** **SAFETY/HEALTH CONSIDERATIONS:** Very toxic to the nervous system and an irritant to the eyes and skin. Ingestion of excessive amounts, neurotoxicity and kidney damage and, for the females, the inhibition of implantation by the chorionic membrane may result in some degree of spontaneous abortion. Avoidance of contact with these areas, especially from 15 to 20 days

**5 LYNN KATZ, RN, LATFACON.** Over 10 years of experience in an acute care hospital in a critical care unit. I am currently working as a nurse in a critical care unit. I am currently working as a nurse in a critical care unit. I am currently working as a nurse in a critical care unit.

**3. FUSING P CELLULOSE.** Another great technique is to fuse a good all-purpose nonfluoropolymer laminate to conductive paste by pressing it to a preheated metal surface. Fluoropolymer can provide the best

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hasil survei, diperkirakan ada  
minyak di bawah 100 meter di  
Gondok, Jawa Tengah. Menurut  
hasil survei, diperkirakan ada  
minyak di bawah 100 meter di

This revolutionary new kind of **upline** utilizes the same basic principle pioneered by **Sevens** in the half-banking street.

It is a good way to engineer the designs needed before construction. Basically, let us you consider the "impacts" in any application, where volume, length and time change under various loads. The flow rate is the flow rate, which is directly proportional to the flow rate, but more, longer life, more dependable operation. It can be used with integral gears, which are, knowing the speed and pressure (or a wide choice of other conditions) for use with standard, hydraulic or pneumatic units. To convert push-pull to rotary motion, ball joints are available with very high loads, ranging from 35 to 1000 L.

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Flow: 100 and 200 GPM

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release) and production of magnetic amplifiers, automatic controls and related instruments. The new UMC division will be headed by Alfred C. Black as general manager and Robert G. Evans, assistant general manager, both of whom have been with DDA since it was founded.

• **Federal Telecommunications Laboratory** has opened a branch Consumer Criteria Laboratory in Palo Alto, Calif., headed by W. S. Charkin, former manager of mirror development at Lyskatt Electric Co. Address: 359 San Antonio Road.

• **Milco Controls Co.**, Park Ridge, N.J., is parent of two companies formed by Milco Rosen, former chief engineer of Best-Moscow Corporation's Rottler Equipment Division. New company will develop and produce magnetic amplifier and transformer devices. Company address: Hawthorne Ave.

• **Little Falls Alloys, Inc., Paterson, N. J.** has added facilities for the hot rolling and tempering of alloy wire. Flat wire is available in beryllium copper, phosphor bronze, brass and other alloys. Company address: 199 Caldwell Ave., Paterson, N. J.

• **International Business Machines Corp.** and **University of California** Los Angeles have established a **Western Data Processing Center** on the UCLA campus as a result of a multi-million dollar gift by IBM which includes the use of an IBM 709 computer. New facilities will be available to

West Coast markets, and also will be used to train students in the use of electronic data processing systems.

• **Sylvania Electric Products, Inc.** and **Corning Glass Works** plan to jointly owned companies to expand their research, development and production activities in the atomic energy field. The new organization, to be called **Sylvania-Corning Nuclear Corp.**, will take over the atomic energy activities of the two companies.

• **Acc Electronics Associates, Inc.**, Sunnyvale, Calif., maker of precision low-voltage potentiometers, has increased its floor space by 25%, the size and each extension within a year.

- **International Electronic Research Corp.**, Buffalo, N.Y., products will be sold by The Don Swann Sales Co. in Alaska, Washington, Oregon, British Columbia, Northwest Idaho and Western Montana. Sales in the states of Colorado, Utah and Wisconsin will be handled by The Ford & Pratt Co.
- **Avco, Inc.**, has appointed Remco Engineering, Ltd., Montreal as its sales and organizing representative in Canada.
- **The Narda Corp.**, Mineola, N. Y., has appointed The M. F. Orlitz Co.

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Worth, Okla., is its exclusive representative in Ohio, Michigan, Western Pennsylvania, and parts of West Virginia. The new representative has field offices in Dayton, Cleveland, Pittsburgh, and Detroit.

• **The Morse Instrument Co.**, Menasha, N. H., will market its products in Southern Indiana, Southern Ohio and Kentucky through The Pacific Equipment Co., Cincinnati.

## WITT FILTER CENTER WITT

• **Midget Molded Magnetic Minicore**—New type of magnetic computer storage element consisting of molded ferro-magnetic cores on thin painted circuit plates will make it possible to store more than a million bits of data on a device the size of a shoebox, according to Radio Corporation of America which developed the technique. The new RCA storage element functionally resembles the Gerdner magnetic core matrix, but it is far less costly to make because it alleviates the difficult problem of threading input-output windings through tiny magnetic cores. Read-out time is quoted at "a few millionths of a second." RCA has constructed a 2,500 bit element, occupying only two cubic inches.

• **Lock Store LARS** (Lock-Store USAF's Low Altitude Release System) which enables fighter-bomber pilot to toss bomb during pull-up phase of its low-altitude maneuver has been test run with a Lear L-10 autopilot which auto automatically pulls engine into preselected position when pilot pushes a button. The autopilot LARS evaluation was pilot training and provides more precise bombing, Lear says. The L-10/LARS system was evaluated in an F-100 and demonstrated during recent USAF Fighter Weapons Meet at Nellis AB, Nev.

• **TWA Buys Collins** FW-1-Twin World Airlines has placed orders for five new FW-1-Twin aircraft from Collins Radio's portable warning indicator (PWI), bringing the total to order to approximately 900.

• **ATC Transponder** (Flight)—The Air Traffic Control Transponder which Rockwell is designing and will produce for Radio Corporation of America will have provision for generating 64 reply codes instead of the 11 now authorized, and modification to provide two additional interrogating codes would not be a problem in a two-way communication system. The transponder also has the capability of spacing its reply codes at 1.45 microseconds into bits instead of the presently authorized

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2.80 second intervals, which would increase the available codes from 64 to 8,192 (AVW Nov. 19, p. 77.)

► **Insulator Conference**—The 1972 Transistor and Solid-State Capacitor Conference will be held at the University of Pennsylvania, Philadelphia, Feb. 14-15. Conference is sponsored by IRI, AIEE, and University of Pennsylvania. Advanced information forms can be obtained by writing P. W. Anderson, General Electric Co., 1185 Chestnut St., Philadelphia 4, Pa.

► **New Business**—Recent announcements of new contracts by aerospace contractors include:

► **Ultrasonic Corp.**, Cambridge, Mass., has received multi-million dollar contract to manufacture "one of the complex sub-systems for the new B 55 (Hawthorne) Bomber."

► **Craig Systems, Inc.**, Denver, Mass., has received a \$1.2 million contract for air traffic control equipment and communications facilities from the Air Marshall Command.

► **General Precision Laboratory, Inc.**, Haverhill, N. Y., reports three new sub-contracts, totaling over \$0.5 million from the Cals in Martin Co., Baltimore. These are in addition to previous \$5 million Martin award for system development and manufacture.

► **Cash Company, Denver**, reports \$71,800 contract from the National Bureau of Standards facility at Boulder, Colo., for 50 VHF radio receivers to be used as NBS scatter propagation research. Some of the receivers, designed by NBS, will be set up in South America.

► **Servo Corp. of America**, New Hyde Park, N. Y., reports a \$145,000 contract from Army Supply Agency, Laboratory Personnel Office, for development of high accuracy electronic feeding unit, designated AN/TRD-15, for use in aircraft carrier programs and as a navigation aid. It is intended to provide electronic feeding on very short duration transmissions.

## NEW AVIONIC PRODUCTS

### Microwave Components

► **Kleinco power supply**, Model PC-13, provides continuously variable output from zero to 10 kv. at currents up to 2 amps d.c. with ripple at less than 0.04%. Similar unit, Model PC-14, provides voltage up to 5 kv. at currents up to 6 amp. for bombardment cathode applications. Both units operate from 230 v., 50-hz., 60 cps. Levorath Electronics Products, Inc., Redwood City, Calif.



► **Frequency meter**, Model 602B, covers range from 1,510 to 10,540 mc., as mentioned over its predecessor, and includes a digital display system for

direct reading of frequency. Accuracy is stated at 0.1%. The Narda Corp., Menlo Park, N. Y.

► **Microwave detector tester**, permits direct readings of permittivity and loss tangent for small samples at fixed spot frequencies. Three different models cover frequency range of 0 to 17 kw. Dielectric measurements can be made at temperatures up to 450C. Microtel Electronics, 16 Ridgewood, London W 2, England.

► **Triplex video detector circuit**, Type DV-50, operates at temperatures up to 150C over frequency range of 1 to 12.4

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line, providing integral sensitivity of more 40 db over the entire range of frequencies and temperatures. The integral design provides a second signal terminal on the control signal. Schwaab Electric Products, Inc., Electronics Div., Woburn, Mass.

• K, local variable power divider, operates over frequency range of 16 to 17 line, has minimum insertion loss of less than 1 db and maximum input mismatch of 1.2. Reflector phase of two equal input signals determines whether energy from two output arms is equal or



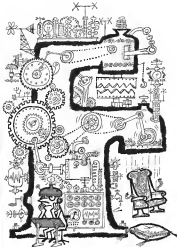
whether entire output is available only at one or the other of the output arms. Phase shift of incoming signals is accomplished by short and induct pads with adjacent areas, terminated in variable short circuits. Further details are available from manufacturer. Wyle Antenna, Inc., Dept. B, 1101 West Elizabeth Ave., London, N. J.

### Test Equipment

• Digital time interval meter, Model 790A, for measuring elapsed time between two events occurring in the range of 10 nanoseconds to 1 second. Optional feature includes extension to 10 or 100,000 seconds. Accuracy is 10 seconds.



seconds. Short-term stability is quoted at one part in a million, long-term stability at five parts in one million per week. Device is priced at \$495. Computer Measurement Corp., 1515 Vine and Ave., North Hollywood, Calif. • Remote control dynamometer, Model 1825-180, will measure stall, starting or running torque of small motor systems and can be provided with maximum torque scales of 0.5 to 6 in. oz. Device



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explosion resistance tests to shock and/or power and collected specimens to measure under maximum torque. Maximum area is quoted at 150. A photo-electric cell type of non-loading tach generator gives motor speed with an accuracy of 0.5% or better. Device can accommodate seven sensors with output shaft dimensions of 0.86 to 0.27 in. Magtek, Inc. Instrument Div., 18 Vespa Plaza, Buffalo, N. Y.

•Miniature air vacuum tube voltmeter, Model 547052, designed for panel mounting to provide exceptional voltage only reads MILI. volts. Units measure 40 x 40 x 61 in., operate from 115 v., 60 or 480 cps, have frequency response of 20 to 16000 cps and input imped-



ance of 1 megohm. Standard accuracy is 1% of full scale, but 2% is available if desired. The Laboratories, Inc., 4025 Merrick Rd., Seaside, N. Y.

## Components & Devices

•Electro-mechanical filter, weighing only 7 oz. and measuring 14 x 14 x 31 in. suitable for single subpanel or panel use, come in Types MBU-2501 for 250 cps upper subpanel use or MBU-2504 for lower subpanel use. Operating temperature range is -40 to 150°C. Radio Corp. of America, Electronic Products Div., Cranford, N. J.

•Miniature voltage stabilizer tube, Type 75G1, requires special stainless steel casing which causes maximum striding voltage is 110 volts in daylight or darkness. The 75 volt stabilizer tube has regulation of only 9 v. over current range of 1 to 60 ma. and the burning voltage varies less than 1% per 5,000 hours, according to manufacturers, Meltek Overseas Ltd. U.S. representative is International Electronic Corp., 31 Spring St., New York 12 N. Y.

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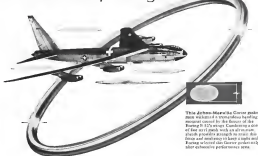
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PRODUCTS FOR THE AVIATION INDUSTRY



## Avco to Build New Research Center

Lansing, Mass.—Avco Manufacturing Corp. will build a \$15 million research and development center devoted to basic and applied science at Woburn, Mass. Dr. Harold F. Smith, president of Avco Research and Advanced Development Division, and the new center (shown) will be in operation by mid-1958.

Research and development division of Avco, acquired 14 months ago, presently is operating in Lawrence and at the Avco Research Laboratories in Everett, Mass. It is concerned largely with advanced missile systems for the Department of Defense. All of the research and development facilities will be moved to the new center at Woburn.

The new center, covering 50 acres, will consist of four buildings and provide over 400,000 sq ft of floor area. Avco expects to employ about 1,500 persons in the new plant.

## Certificates of Necessity

Washington—Office of Defense Mobilization has awarded Avco Manufacturing Corp.'s Research and Advanced Development Division a certificate of necessity for accelerated tax deduction in the amount of \$3,975,550 for research and development facilities. Of the amount certified, 75% is allowed at the rapid rate. Other certificates awarded.

Moisant Aircraft Corp., St. Louis. Military aircraft and bomb order. 474,000 certified with 50% advance and \$1,410,000 certified with 60% advance.

Lantern Aircraft Corp., Lincoln, Nebraska. Military aircraft. \$1,117,000 certified with 60% advance.

Wing Aircraft Co., Scottsbluff, Neb. Military aircraft. \$1,117,000 certified with 60% advance.

Mac Truck Co., Lawrence, Mass., military aircraft parts. \$1,117,000 certified with 60% advance.

Caled Aircraft Corp., Pitts & Wright, Aircraft Division, Scottsbluff, Neb., military aircraft engines, and its certified with 60% advance and \$1,410,000 certified with 60% advance.

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IDENTIFICATION of shots (left) of front gate outside forward section imparted to the Soviet 'skate' by the black gate in the rear. Intel (right) is landing only a few yards from the X target, part of which can be seen in the lower left of the photo.

## Sky Diving May Revise Armed Forces

By George L. Christian

New York—Sky diving, a relatively new parachuting technique in this country (AW Nov. 19, p. 55)—may bring about a major revision of our military reconnaissance capability if adopted by the Soviet forces.

Both the Marine Corps and the Army are attracted to the new technique. Marine Reserve Capt. Jacques A. Bell gave a sky diving demonstration to Marine Corps officers at Quantico, Va. last month and was scheduled to give a similar demonstration to Army officials at Fort Belvoir, N. C., about mid-December.

### Team Capable

Intel, who captured the news of American sky dives at the International Parachutists Meet at Moscow, last summer, also demonstrated a Russian black gate, a movable device in his exhibition. Intel supplied the Soviet parachute, the suit and in this country—during his last to Moscow. He also has a new type triangular parachute made in West Germany which is reported to be one of the best recent designs of that design. He had not had a chance to try it out at the writing.

Intel told *Aviation Week* he has reason to believe that U. S. reconnaissance is probably techniques are the Soviet Union, the Russian, long gone behavior in the military potential of the parachute. He feels that, in considering the free-falling techniques of sky diving with the discolored, variable opening and slow landing capabilities of the Russian black gate, the Soviet Union the U. S. can introduce its reconnaissance in parachute methods.

Of significance is the fact that the accuracy of the new, slow diving technique is particularly adaptable to the new Marine attack concept of vertical envelopment and acquisition of bases, both of which require high accuracy reconnaissance reports.

To date, the Marine Corps has been non-committal on whether it will adopt the sky diving techniques as an official project.

(A Marine Corps spokesman in Washington told *Aviation Week* that the reason is attributed to Intel's sky diving techniques since it is interested in any means of improving Marine Corps operations. He stated that sky diving allows a parachutist to do a more purposeful job of hitting an objective when jumping from high altitude than if he left in the conventional, uncontrolled manner.

(The Marine officer added that even as sky diving may have a potential as such operations as post-landing work—parachuting, such as ahead of most attacking forces, and acting as underwater observation teams of the future. As he put it, as the last Marine amphibious operation involved landing on the beaches, in the next the Marines will go over the beaches.)

Intel and the three agencies which sky diving can bring to reconnaissance are science, science and science.

Current method of parachuting reconnaissance personnel is to fly down to destination in such aircraft as a C-47, C-119 or possibly, a helicopter, and drop them from altitudes of 100,000 ft. The method is slow, slow and only fairly accurate.

Intel envisions bringing the parachutists in at high altitudes—about 12,000 ft or more—and dropping them from fast diving planes like, perhaps, the C-119. Intel said that it is feasible for the next 10 years from now, but that this would require a lot more planning, work and practice than currently has been done with sky diving in this country.

By coming in high the noise of the plane is greatly reduced. The parachutists' plane might even be in with



BACK PACK usually is used, short probe being held for emergency. In Intel's hand (left) is a home made streamer used to detect wind shift inside of a wire netting bagged with lead, with orange paper attached. Altitude and stopwatch and on parachute (right).



## Parachuting

as aerial reconnaissance means or a bombing tool to camouflage the mission.

The man has told stories for a number of years, when the chute opens, the plane is out of control.

The jumpers and sky diving both control techniques to direct themselves towards their targets and to avoid getting into uncontrollable and possibly fatal collisions such as tumbling or opening.

### Steepest Used

The parachutists open their 'skates' at about 500 ft. Use of a device, which is pulled down from the area canopy by a pilot parachute, helps reduce the noise of the chute opening.

After the parachutist's mission is accomplished he can be retrieved on the fly by an aerial pick up system such as the one developed by All American Engineering Co., (AW Dec. 12, 1955, p. 70).

Intel estimated that accuracy of 200-300 ft from target could be obtained consistently with jumps from 12,000 ft.

He emphasized, however, that this new sky diving technique does not apply to mass drops of troops.

Intel made two jumps for the Marine



INTEL'S PARACHUTE opens after a sky dive of about 6,000 ft. Chute is a Berry type with two small vents. During the sky dive Intel guided himself through one fall figure type while on way down. The small target by 200 ft.

with varying input and varying load

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**Abstract**



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Electric Machinery and Equipment Division

5111 W. Washington Blvd., Los Angeles 13, California  
 Published 3-2011 • PFE LA 1004

**Corps at Quarters** He said that many officers from the Tactics Board and Equipment Board were present to watch the games.

Plane used was a single-engine Cessna observation ship piloted by Marine Major R. Gossard.

### Gentle Weather

Winds shifted more erratic and blowing at about 30 mph. On the ground winds

The first jump, a six dive, was made with a Dive-type chute from an altitude of 6,700 ft and delivered pulling the rip cord for 30 seconds until he reached an altitude of about 950 ft. During the fall he made a figure eight, then stabilized himself for the rest of the four fall. He reached the target by about 150 ft.

The second jump, a jump-and-pull leap was made from 2,500 ft. using the Bensen link gear chute. In spite of the wind conditions, the chute's maneuverability enabled him to land within 12 ft. of the mark.

A complete application engineering service aimed at reducing overhead handling costs is being offered by Lewis-Shepard Products, Inc. The Watertown, Mass., firm manufactures electric lock trucks and related equipment. The plan is designed to help companies who handle large quantities of materials in determining their operation and to reduce expert advice on such matters as equipment replacement and procedures improvement.

Jacqueline Andax Intel & Co (see page 96) has been awarded a public subscription account by the basic associate



### Seventy-five Ton Platen

Two 75-ton platens will house the male cylinder of a new 600-ton capacity by double no-draft forging press being built by Lake Erie Engineering Corp. for PFC Corp., of Franklin Park, Ill. The 30-ft. high machine has a bed measuring 58x110 in., a stroke of 48 in., and weighs 750 tons.



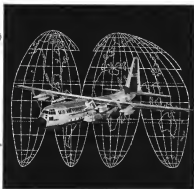
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## New Propjet Global Mobility for TACTICAL AIR COMMAND



### C-130 HERCULES

#### Delivered to 18th Air Force, Ardmore AFB

Moving anything, any time, any place on earth is the responsibility of Tactical Air Command's 18th Air Force. The new Lockheed C-130 Hercules—propjet "strongman" of the USAF, first assigned to the 463rd Troop Carrier Wing—does this job faster, better, at lower cost than any other combat carrier now in service. The Hercules is powered by four Allison T-56 propjet engines.

**LOCKHEED** LOOK TO LOCKHEED FOR LEADERSHIP

LOCKHEED AIRCRAFT CORPORATION, GEORGIA DIVISION  
U.S. Air Force Plant No. 4, Marietta, Georgia Nuclear Laboratory, Savannah

industry is the U.S. consisting of Farnsworth Research Co., Inc., Monrovia, Calif.; Swarth, Pasadena Co., Inc., Tustin, N.J.; and Irving Air Chute Co., Inc., Lexington, Ky. He also has a short duration immediate contract with the U.S. Army Quartermaster Corps.

MB Manufacturing Co., makers of vibration isolators for guns and jet aircraft engines and collectors of seismic equipment, have opened a western field service office. Address: 33035 Washington Blvd., Colton, Calif.



#### Rubber Pressure Suit

Full-pressure pilots need developed for Navy Bureau of Aeronautics by Arrowhead Rubber Co., Los Angeles, Calif., a new suit produced by the company in limited quantities for foot evaluation. A soft rubber garment the suit features flexible but has no joint members under pressure. Bellows are located at the shoulders, elbows, knees, thighs and hips. Bellows are the present completely and the pilot handles oxygen from behind. Ventilated undergarment made with the suit is made as that developed for the Navy Grumman full-pressure suit (NAV Ord. 15, p. 11). Arrowhead claims its judgment was in the light of its type. It is the first full-pressure suit to be flexible and comfortable in use.



Unusual aerodynamic design of the F-104A Starfighter gives this slim, razor-winged streak of fighter power the greatest combination of speed and flying performance ever built into a combat airplane. The high tail is a significant contribution to precision control... just as Camloc's 400Q Series quarter-turn fasteners on the F-104A's access panels are a significant contribution to security in flight and speed of maintenance... Camloc quarter-turn fasteners open fast, close fast, hold fast!



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## 35 ton bomber gets carrier shakedown

Largest and most powerful aircraft ever to operate from a carrier deck, the Douglas A3D Skywarrior has now completed landing and takeoff tests aboard the U. S. S. Forrestal—the Navy's mightiest carrier. Able to deliver the A-bomb, at speeds above 600 mph, Skywarrior is designed to extend our carrier's striking range beyond any point yet reached.



U. S. Navy's atom bomber, the Douglas A3D Skywarrior

Confined to carrier in aerial combat, it can fly without skilled flight at the controls. If you are interested in a career as a Naval Aviator, drop a card today to: *Nav. Cad., Washington 25, D. C.*

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Injection Molds for Plastics

Last cost plastic injection molds in a wide range of sizes and materials can be cut on portable bench-type machines called Avimold AFM 21. Mold size close to hand operated and constructed for fast and short production runs. It has temperature-resistant copper tool and patented lock-proof, self-aligning, interchangeable cylinders. Cuts lock into holds molds of various sizes and thicknesses.

Ram and cylinder are made of heat-treated and chromium plated alloy steel for long life and clean operation. Same heat treatment assures an aid of setting is assisted by rotary knob that has heavy damped scale. Thermocouple at hold in closed contact with cylinder to heat cylinder. Cast aluminum body and base is finished in hard stone enamel.

Injection pressure is 5,700 psi. Heltek Molding and Foundry Supplies Ltd., Dept. FR-24, 80 Shore Rd., Port Washington, N. Y.

### Conductive Silicone Rubber

Electronically conductive silicone rubber is superior to conductive organic rubber in that it can easily be molded, sterilized or extruded without changing its electrical properties. It is called X-1516 Silicone Rubber Compound. Because of its resistance to temperatures up to 1000°F, it can be used for such applications as anti-static bumper pads or aircraft controls. Other possible applications are building for silicone in related wire, static grounding latching knee and industrial pressure seals capable of being cleaned by heated or oil degreasing solvents. Like other silicone rubbers X-1516 is thermally stable, res-

ists, and resists weather, ozone and acids. It can be produced with electrical resistivity less than 100 ohm cm. Salesman Division, Union Carbide and Carbon Corporation, 50 E. 42nd St., New York 17, N. Y.

### Gyro Ruler Alloy

High strength, high density alloy for pressure rotors called Helcor 1000 Coromax is said to have considerably higher stability and strength than other rotor materials. Permissible rotor speeds are 25% higher, permitting gyroscopes to be designed to smaller size. Greater stability should be useful for aerial guidance applications where great precision and uniformity are needed. Gyro rotor is a sintered alloy of tungsten, nickel, copper and small amounts of other elements. It has a density of 18.70 to 17.05 g/cc. Proportional elastic limit is 62,000 psi. Modulus of elasticity in tension is 44 x 10<sup>6</sup> psi. Fatigue limit is 55,000 psi. It is readily machined and is available in a variety of stock forms and sizes.

F. R. Muller & Co. Inc., Indianapolis 6, Ind.



Metal Protecting Spray

Aluminum alloy test strip coated with Solignum 1340, a silicone resin dispersion in compatible organic solvent, has withstood 2,000 hr. exposure to salt spray (ASTM B117 42T). QQ-M-151a) without evidence of base metal attack. Film was sprayed on, air-dried and baked for one hour at



Oil Flow Operation

Hydraulic test stand that will check out oil flow operation of aircraft valves up to 20 gpm. and valve pressure up to 3,000 psi, has been added to The General Corp.'s Aircraft Hydraulic Service Division. Test equipment enables technicians to overhaul hydraulic systems in one stand-up to General and DOD usage. Two pressure coated leads will handle two pressure operations or three flow operations simultaneously. Test capabilities on hydraulic valves and cylinders include high pressure static test (to 1,000 psi), bridge test in relief and unrelieved, timing test, where oil pressure test and controlled oil displacement. Normal operating range up to 3,000 psi is provided by a three-phase, 40 hp. pump pack. By using a handpump the test range can be increased to a maximum of 12,000 psi. The stand will also check pump efficiencies up to 1,000 gpm.



## LEAR TRANSISTORIZED AUTOPILOTS

AT THE VERY BAWN of the jet transport age, Lear automatic flight controls are already in the air guiding Air France's Caravelle jet transports on route indoctrination air freight runs. And when the Caravelle enters regularly scheduled passenger service next year, an all-transistorized autoliner autopilot, the Lear L-17, will be at the controls. This will be the first all-transistorized autopilot in airline use.

And for the United States Air Force, a Lear L-10 autopilot in the Boeing KC-135 jet transport tanker will provide the rock-steady systems of flight required for the most exacting of all aerial maneuvers: air-to-air refueling of a bomber at jet speeds. Its automatic flight controls for the new military and airline jets, Lear is again first in concept, first in production... to meet tomorrow's precision needs of aviation today.

4547 before being put in the air box. The coating is 0.2 mil thick and has shown no loss in adhesion during testing. Cost averages 2 to 3 cents per square foot in normal applications. It has been successfully applied to many materials, both wet and wrought, and its baking temperatures is low at 248F. The coating has been described as hard, durable, flexible, transparent and tightly adherent. It has been used as a release agent in large amounts most often coating to aluminum ions.

Schwab Process Co., Housatonic Rte., Grand Rapids, Mich.

### Mass Flow Computer

Rapid solution of compressible flow problems is possible with Circle Variable Density Computer. Test studies show that accurate solutions can be had with computer in one-tenth the time required by older techniques based on one-dimensional flow theory. It permits the evaluation of total pressure loss in air flow systems and the determination of fluid properties at any point in the system. Computer consists of 17 flow scales on one side and 17 dial rate scales on the other.

Freight & Kibel, Inc., 5 S. Wabash Ave., Chicago, Ill.

### Ultrasonic Soldering Iron

Low-cost ultrasonic soldering iron is capable of soldering without flux on the metal surface. It is useful for sol-



dosing aluminum and other metals which form solvency oxides that cannot be removed by flux. Oxide film is removed to permit wetting action by the solder in transmitting solvency solvent through surface solder. Wetness produces exploding reaction bubbles which remove oxide film. Soldering iron can be replaced by turning bath which operates on same principle.

Automatic Associates, Inc., Glenwood Landing, L. I., N. Y.

### Heat Exchanger

Very heat exchanger coils utilize jet pump's high velocity jet in Navy PFD. It is part of a do. air pump circulation which provides an independent pressure supply for the jet. Before entering jet, steam is preheated as it flows through heat exchanger. Cooling air flow across exchanger is moved by draft fan. Exchanger is made of aluminum and is of plate fin or extended surface



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Magnetic amplifiers  
Muscle controls  
Navigation systems  
Process engineering  
Pumps, aircraft and industrial  
Radar  
Sonic windmills  
Systems analysis  
Test equipment design  
Transistorized circuitry



### Tow Target Test

An Research and Development Command (ARDC) tests tow targets by attaching to series of long helicopter cables. Tests which have been conducted to determine load. Tests have a maximum total sustained speed of 300 knots is required. Target is observed visually on closed television circuit, actions can be stopped at any desired point to recover target for close examination. Target shown is made of nylon reinforced with other

# LEAR

## These are units (by Western Gear)



## that are part of the system... (also by Western Gear)



## that lowers the wheels



## on the plane that Lockheed built



At least U.S. Air Force transport in production, can be sure of dependable performance from the landing gear actuating system. This system and other Western Gear products aboard this aircraft including motors, gear boxes, shafts and actuators have been tested in Western Gear's blacking laboratory to ensure dependable operation under every conceivable condition of flight. Western Gear believes in its slogan, "The difference is reliability." Its products prove it.

There's a Western Gear aircraft specialist immediately available to help solve your mechanical power transmission problem. Call on him now. He'll be glad to help. Address: General Offices, Western Gear, P.O. Box 182, Lynwood, California.

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construction. It is capable of lowering temperature of air inside up to 140° from between 90 and 110° with various cooling flow. Air flow through the unit is variable from 25 to 1.5 ft./min. and can control internal temperature to within 10 °F. of ambient. Exchange weight less than 1 pound. Housing measures 4 x 5 1/2 x 2 3/4 inches. It meets requirements of MIL-E-5172A.

Alfresco Manufacturing Division, The Cassini Corporation, 9051 Sepulveda Blvd., Los Angeles 45, Calif.

## ALSO ON THE MARKET

Model S4/S18 Freest Load Isolator, engineered for maximum size and weight provides 15 lb. isolation over a 300 MC load with less than 2,500 cpi to 3,000 cpi. With wedge-type flanges, maximum reaction less than 1.0 lb., maximum input VSWR at 1-5. Unit can handle up to 500 KW peak power and 250 m. average without external cooling. —Lectro Industries, Components Division, 1875 Redwood Rd., Los Angeles 16

Traffic signal for airport control tower, reported to be an advanced transmission and public can be operated with our land. It meets the requirements of CAA

Specification 936. Signal weighs 8 lb., 10 in., and measures 10 in. long x 1 1/2 in. high. By means of a concentrating type parabolic searchlight reflector, unit reflects a high intensity beam of 50,000 candlepower.—Cassidy-Gladco Co., Wall & 7th North St., Syracuse, N. Y.

A2507 cooling cap and anchor locknut is designed for integral anchor that holds in which space for setting is limited or where bolt holes are close together. There prevents leakage up to 50 psi on either side of the seal. It conforms to MIL-N-19127 (ASG) requirements for torque, leakage, burst-out and push-up performance.—Elastic Stop Nut Corporation of America, Union, N. J.

Aircraft trim material of vinyl coated DuPont fabric, low hysteresis, side panels, mounting, etc., is fire resistant, easily tailored, light weight and mold-proof. Material is available in standard 94 in. width, in a range of vibrant colors.—Sawco-Tower, Inc., Stanley Ave., Waltham 71, Mass.

Aeroco Stand Burner will measure burning rates of explosive and jet and rocket fuels in the closed 60 second, in nitrogen atmosphere, under high pressure. Four models are available with variations in pressure ratings 10,000, 4,000, 7,500 and 2,000 psi. Electric

control is passed through the electronic heating element. The test stand, in three pieces, measures loading, points, force, clacks are selected to determine exact burning rates.—American Instrument Company, Inc., Silver Spring, Md.

## WHAT'S NEW

### Publications Received:

**Avionics, Propulsion, Structures**—by E. A. Bower, M. J. Zeevaert and C. W. Bower—Edited by Guyon Merritt, Capitan, 1286-Pols in D Van Nostrand Co., Inc., 120 Alexander St., Princeton, New Jersey 5100, 795 pp.

Second volume in the series "Principles of Guided Missile Design", covers the design fundamentals of new side supersonic aerodynamics, means of propulsion and structural design.

Review in Purple—Copyright by Industrial Research Institute, Inc.—For sale through New York University Press, Washington Square, N. Y. 1, N. Y. 5400, 65 pp.

Proceedings of a symposium held during the April 1956 meeting of the Industrial Research Institute. A discussion of the movement, materials,

## NEW MODEL 21 AMERICAN MECHANICAL INERTIA REEL HAS WIDE ANGLE OF INERTIA RESPONSE

An entirely new shoulder-actuated take-up reel, built and approved under Spec. MS-8-823A, Type MA-1.

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7. Second control requires no adjustment in case of overloading. Positive push-pull control cable prevents reverse motion operation when used on adjustable reels.
8. One new, mounting hole spacing to other holes of our attachment.
9. Easily removed. Manual control control cable, or reel can easily be replaced without disturbing other components. Handle cable in reel can be replaced easily by service personnel.
10. Samples available for your development work.

Model 21 Inertia Reel

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**The Flying Years—by Louis Richman—**Pub. by Henry Holt and Company, 385 Madison Ave., N. Y. 17, N. Y. \$9.95, 354 pp.

Mr. Richman, who retired as a lieutenant colonel in the Air Force, tells the story of his career as aviator.

**The United States Air Force Dictionary—**Edited by Woodard A. Hall—Pub. by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. \$4.75, 550 pp.

Compiled through the facilities of the Research Studies Institute of the Air University, this is a dictionary of the new language of the air.

**New Era of Flight, Announces Single—**by Louis Zucchi and Robert H. Miley—Pub. by G. P. Putnam & Co., Inc., 380 Fourth Avenue, New York 30, N. Y. \$3.75, 176 pp.

Clearly written, understandable photo book on military aviation compiled for the purpose of applying the subject for young readers.

**Vietnam Flow Theory Is-Lessons Flow—**by Dick L. Pugh, Jr. D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, New Jersey 07713, 408 pp.

Thorough study of human flow of nature, observable flows with special attention to aerodynamics and other engineering applications.

## Reports Available

• **Yarns Properties of Aircraft Structural Metals at Various Rates of Loading After Rapid Heating** (PB 121157)—By G. E. Thomson and J. S. Kottler—Prepared by Southern Research Institute for Wright Air Development Center, and available from GPO, U. S. Department of Commerce, Washington 25, D. C. \$4.50, 474 pp.

• **Variables of stress rates from 0-3000 in./in./sec. and holding times at test temperatures from 10 seconds to 10 minutes** were used to test the tensile properties of six aircraft structural sheet metals after being heated to temperatures up to 1100F within 10 seconds. The results are shown.

• **Conference on Materials and Design for Low Temperature Service** (PB 121089)—Prepared by Engineers Research and Development Laboratories, U. S. Army, and available from GPO, U. S. Department of Commerce, Washington 25, D. C. \$10.00, 480 pp. Valuable in particular as a background guide for designers and fabricators of low temperature equipment, the volume is a compilation of pro-

1912 data, but one of the few comprehensive collections of material on the subject.

• **Aerial Cartography, A Historical Bibliography Study of Aeronautical Charts—**by Walter W. Rostow—Pub. by the Library of Congress, and available from the Card Division, Library of Congress, Washington 25, D. C. \$5.50, 174 pp.

As the title indicates, this book includes an historical summary and a bibliography of aviation cartography.

• **New on the Wilson Method of Variable Supersonic Wind Tunnel Design—**by M. M. Callan—Industry report 18-1774 of the National Aeronautics Establishment, Montreal Road, Ottawa, Ontario, Canada, 64 pp.

The Wilson method of nozzle design is discussed and criticized, and from the results obtained a new method based on the method, criteria only for the basic function used in the development are suggested.

• **A Review of the Air Force Materials Research and Development Program** (PB 111645)—by Marj M. Selam, Wright Air Development Center, U. S. Air Force, 5550, 137 pp. This publication is supplementary to two other volumes, also available from GPO, of the same title. They are PB 111644, covering Air Force



## Ropelock

A new loading device, called Ropelock, has been put on the market by Army Corp. Designed to be used with 1 in. to 1/2 in. diameter rope, the device automatically and uniformly loads rope into the opening of rings where rope tie-downs is involved. The Ropelock automatically unloads whenever tension is applied to the rope without allowing any slack through the use of a single turn, the device's only moving part. Men must tension the Ropelock by hold on 1000 lb. with rope and 700 lb. with rope rope. Load can be manually released by depressing the rim. Ropelock which is built for less than one dollar, is manufactured by General Logistics, 900 South Elm Oaks Ave., Proctor, Calif.

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## A message to engineers from an engineer-president



Maquardt was incorporated in 1944 by five engineers and three Los Angeles businessmen to explore the potential of the rocket engine — then merely a laboratory curiosity.

Twelve years of sound engineering and research have really paid off. Today we employ over 2000 people at Los Angeles and Ogden, Utah and expect to triple in the next two years. Of course, many of our new associates will be in manufacturing — which is fine. Every engineer wants to see his "baby" accepted and in production. However, the outstanding work of our present engineering and research team has also opened up big new requirements for engineers in almost every specialty in areas varying from production engineering and qualification testing of present models to advanced research on starting new breakthroughs in high speed propulsion — new chemical fuels and nuclear energy.

It is not too late to get in on the ground floor in engineering the rocket engine — the powerplant of the future. Write me personally.

*Roy E. Maquardt*

Raytheon Aircraft Co.  
Van Nuys, California



### Fork Dump Truck

This electric fork truck incorporates a mechanism which allows the operator to rotate the forks through 90° deg. in either direction to dump small parts from customers into hoppers. Movement is controlled by a hand-operated hydraulic valve. The rotating assembly can be installed on any 4200 lb capacity fork truck produced by the manufacturer. Address: The Raymond Corp., Germantown, N. Y.

materials research from July 1, 1953 to June 30, 1954, \$2.75, and PB 111517, covering the 16 years of research prior to July 1, 1953, \$3.75.

• **Collection of Papers Presented at the Colloquium on Statistical Design of Laboratory Experiments** (PB 121181) — Prepared by Naval Ordnance Laboratory, \$2.75, 162pp.

• **A Flight Test Investigation of the Sonic Boom** (PB 121152) — by M. E. Muller. Air Force Flight Test Center, Edwards Air Force Base, \$1.00, 48pp.

• **First Joint Military-Industry Packaging and Materials Handling Symposium** (PB 121150) — A record of the proceedings, including over 18 papers presented at the symposium, \$0.90, 65pp.

• **Report of NRE Progress**, published monthly by the Naval Research Laboratory, can now be obtained on a subscription basis. Annual rates are \$10 for domestic, \$15.00 foreign. Single issue price is \$1.75. Orders should be addressed to OTR, U. S. Department of Commerce, Washington 25, D. C.

Each issue of the publication contains articles and "problem notes" on current NRE-sponsored research and development.

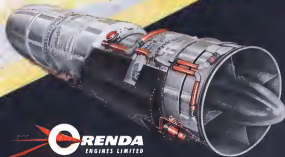
• **A Study of Magnuson-Fair Enthalpying Agents** (PB 121175) — by L. M. Conover and S. I. Rabinow, Fairchild Laboratories, Inc. for Wright Air Development Center, \$3.75, 146pp.



### A SEVEN-JET B-477

In this case, yes. The seventh jet, in the rear fuselage pod-mounting shown above, will be Granda's Ingoquo, designed for supersonic speeds.

The Boeing B-47 is on loan from the United States Air Force for flight testing the Ingoquo in the initial subsonic phases.



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# project VANGUARD poses a problem...

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to this time integral.

...and REEVES comes up with the solution

Placing the earth's satellite in its pre-determined orbit requires precision to the 100 degrees. The second-stage of the three-stage rocket which will carry the satellite up to its orbit must be expended shortly before its trajectory bends back towards the earth.

Super-velocity of the second stage is controlled by a constant time computer designed and built for the Martin Company of Baltimore by Air Associates, Incorporated.

The Reeves Instrument Corporation has designed and is building for Air Associates the "Reedman" needed for manipulating the second-stage waiting time as a function of the terminal speed. Essentially, an integrating accelerometer, it provides a continuous record of velocity as the rocket speed builds up and feeds this information into the control unit's computer.

The control unit, after the computed waiting time has elapsed, triggers the system. Stage two is accelerated and stage three gives the satellite the final acceleration required for placing it in the satellite orbit around the earth.

Because of its vast experience in design of precision gyro and accelerometer, Reeves has been assigned the task of developing an important sub-system for one of our great ventures, Project VANGUARD.



STVA

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## BUSINESS FLYING



BEACH PMAIAT TRAINING PICTURE changes next year when Cessna T37A jet joins with Beech T34A to replace T34A (background).

## USAF's Contract Training Saves Money

By Erwin J. Roth

Moore, Tex.—USAF's Air Training Command is saving American taxpayers an estimated \$31.5 million annually with its civilian contract concept for pilot training.

Efficiency of the operation was first first to be attested by these figures: the new schools opened by the civilian contractors require a total of only about 6,500 civilian and 150 Air Force personnel. One civilian contractor estimates that the same operation, if run by the military, would take about 27,000 of both men and women.

### Average Cost

Air Training Command, Maj. Gen. H. K. Sperr, commanding, notes that at the last five years, January, 1961, through December, 1965, the nine civilian operated primary flight schools have trained 70,000 students, graduated 27,682 at an average cost per graduate of approximately \$6,000. Through this period, operating costs have gone up only about 12%, despite changes in equipment, increased length of course, pay increases and the like.

Problems of all more schools are now

in Air Force view of a civilian layout as much as feasible so as to maintain a reasonable hope for compressing the operation periodically and providing a competitive spirit among them. Each school operates some 134 aircraft, 93 Beech T34As and 100 North American T28As.

To provide incentive, Flying Training Air Force, commanded by Maj. Gen. D. P. Dawson, sets all schools awards as for most aircraft accident rates, attrition rates in process, quality of students graduated as chosen by their aviation in base and excellence of command management.

Based on these ratings, an awarded fee of 50 cents per student flying hour is paid the first three training schools and five cents an hour bonus to the next three schools. This is over the fee of \$5 cents to \$5 cents per flying hour under fiscal 1957 contracts covering the schools' Beech T34As and North American T28As. Data covering the current year are not yet available but figures covering the last few calendar years, compiled by the Air Force Training School, show that the contractors have been making an average net profit of \$12,000 after taxes,

with the net profit percentage on gross receipts after taxes being 82-85%.

Contract procurement is handled by Air Materiel Command, contract administration by Flying Training Air Force.

Incumbent business subcontracting, TheTAP does not hesitate to turn on the pressure to accomplish its training mission. An example of this occurred in fiscal 1964, when following a submission in the scheduled training fee, Gen. Dawson told the contractors that they had to maintain the planned pilot pool without cutting training quality. The result: contractors topped 150 civilian from their payroll.

### Moore Typical

Typical of the civilian contract primary training schools is Moore Air Base, an 11,400-acre facility with three A306-H runways and Missouri, central Missouri by accident under the sign of Air Training Command and the Air Materiel Training Society, an association of operators handling military contracts.

Comprising 732 civilian and 15 Air Force personnel, Moore is operated by California Eastern Aviation, Inc.,









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clude a minimum cross-country time of eight hours and country and 11 h. ads, the sole responsibility including two scheduled follow-up meetings, with one leg of the flight being at least 100 mi. The program is intended to turn out pilots meeting Civil Aeronautics standards to report landing in airplane and in some possible commercial applications, including navigation, weather, radio, flight planning and cross-country.

### Professional instructors

Ground schooling will be provided by individual CAF instructors using past professional instructors teaching a standardized course. CAF recently completed a series of air tests, training films and recordings which will form the basis for the ground instruction. The material will be made available to the organization's 3,000 pilots.

Gen. Agre stated that all construction will be given by CAA-qualified instructors who have been in business at least one year. Each operator will be asked to work within a "reasonable" radius of his school and provide instruction for remote areas. A CAA agent will monitor each CAF center at the end of 30 h of instruction and a flight examiner will give the final check for a private license.

Operators will be paid \$508 per CAF credit toward full pay when the student passes the 10-h check ride, the remainder when he receives his private license. For students, the operator will be paid a predetermined fee for dual and solo time, maximum being time which will be permitted; before weekend will be 12 h; dual and night hours solo.

### Scholarship Basis

Flight training will be provided to CAF cadets at three third year of training on a scholarship basis: during the first and second year the cadet will receive private instruction and simulation flights.

The program would start in the Southeast region, comprising Texas, Oklahoma, Mississippi, Alabama, Louisiana, New Mexico and Arizona with 100 scholarships. This phase would provide first year operation in this region with \$218,000 of business first year.

In the second year, it would become nationwide, providing 2,000 flight training scholarships, then each year for the next three years, the number of students will be increased until CAF is providing flight training for 80,000 cadets annually.

Dissemination of the new flight program started in 1956 with appointment of a research committee in Gen. Carl (Toots) Sparks, chairman of CAF's executive board.

## PRIVATE LINES

Instrument training for 135 commercial pilots of the South Area will be started by Tulsa Academy of Aeronautics, Oakland, Calif., Jan. 7. U. S. Army contract calls for Tulsa to supply 11,500 hr instrument flight instruction and 13,800 hr ground instruction through Dec. 6, 1957.

Cooperative promotional and advertising agreement has been developed by National Air Test Conference and National Car Rental to stress to pool efforts in developing business markets. National Air Test Conference members comprise over 175 members located at about 200 airports. National Car Rental has an international network of nearly 400 offices and some 10,000 vehicles.

Beaumont & Co., Miami, a Goman representative for the Johns Bonanza, has tried to land gear damaged to permit smooth operation into rough airfields.

U. S. helicopter exports in the first 10 months of 1956 totaled 158 units valued at \$25,900,000, with 10 of these being shipped in October valued at approximately \$5 million. Europe received 126 helicopters in the Jan.-Oct. period, 11 went to Western European export markets and 15 to other areas. Shipments do not include new and used main wing aircraft shipped overseas by airlines as Douglas, for MDAP or the Armed Forces.

Modification kit to improve Panchard C-47 single engine performance is being developed by Sherard Davis, Inc., Los Angeles, Calif. Kit will cost between \$40,000-\$50,000 and availability is planned for early February.

Outline for teaching aviation courses has been sent to all high schools in the state of Washington by the Department of Public Instruction. Special committee, headed by Congressman Mearns, president of Washington State Aeronautics Assn., prepared the outline. The course is designed to provide science credits for school use or two semesters and will qualify pupils to take Civil Aeronautics Administration written examination for private pilot certificate.

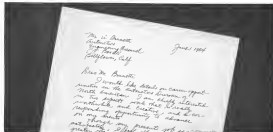
Decommissioned atomic bomb lights are available at no cost to any public agency that will contribute their operation in an aviation aid. Lights are being taken out of service to protect federal funds to train students. Requests for the bomb lights should



### Teacher Builds Roadable Plane

Flying model of a roadable personal plane that cruises at 55 mph, on the air and dual 30 mph, on the road is being developed by Dr. Lewis A. Jackson, faculty member at Central State College, Ohio. Its strikingly simple, the 35 ft. 4 in. wing is integral spanning over the fuselage, offering a total width to 7 ft. 6 in. Fuselage was built from Fiberglass, 1/4 and 3/8 inch components and has a 720 lb empty weight. Gross weight is 1,150 lb. Fuel tanks on lower wing and motor fuel tanks located in the nose section provide 100 miles of range on the ground. Dr. Jackson reports. He is now improving the home built to provide increased performance and then after testing, General Motors, designated Versatile, is powered by an 85 hp Continental engine. Dr. Jackson started development in 1956, taking small model replicas prior to building the present full-scale version.





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## SAFETY

### CAE Accident Investigation Report:

## PV-1 Stalled Too Low For Recovery

A Lockheed PV-1 N 2080C crashed and burned at 10:00 a.m. on Jan. 28, 1976, three miles west of Southtown, L. I., N. Y. Three pilots, the only occupants, were killed and the aircraft was destroyed by impact and ground fire.

N 2080C took off at 10:01 on Jan. 28, 1976, from MacArthur Field, Ronkonkoma, L. I., N. Y., on a low-level pass over a local flight with three pilots. Their wing leader, J. Walker, check pilot, and pilot Raymond Hensley and Major D. Zivings. The purpose of the flight was to qualify PV-1s for the Lockheed PV-1 aircraft, a type he had never piloted.

The talent of N 2080C was noted around the southeast and made under VFR (Visual Flight Rules) conditions with Pilot Hensley occupying the left or captain's seat and Pilot Walker at check pilot seated in the right or copilot. Pilot Hensley acted as observer. Subsequently the PV-1 was seen over the Southtown area flying south at an estimated altitude of 1,500-1,600 ft. When a witness reported that the engine stalled several feet but that the aircraft appeared to be flying at a slow speed.

Witnesses stated that shortly thereafter the engine power vanished as though it was cut momentarily and then came back on. At an altitude of approximately 2,000 ft the aircraft was seen to dip down and pull up sharply once again and then fell off to the left making two to three turns of a descending spiral and changing behind the view of the witness. A witness reported from the woods near the area where the aircraft was last seen, followed quickly by a large release of black smoke.

### INVESTIGATION

N 2080C was found to have crashed and burned on the south side of a wooded field at about 200 ft alt. (mean sea level) three miles west of Southtown and three miles of a mile north of the Southtown area. The accident occurred at 10:01 after the aircraft had taken off from MacArthur Field. Impact marks were found along the top of a shallow 40-ft. ditch at an angle of descent of about 40 degrees. The PV-1 fell about the ground on its left side with the wing down about 45 degrees. It fell in the same position and both engines and a fuselage section behind of 235 ft. Impact destruction was extensive. Both wings were partly crushed and severed from the fuselage and both engines were torn from the nacelles. The steep angle of descent into the ground revealed the aircraft wreckage to an area 44 ft long and approximately 50 ft wide.

Ground fire broke out immediately after impact and completely gutted the fuselage and engine section. A considerable portion of the engine control system was destroyed, including the fuel and oil control systems. Because of the almost complete destruction of the cockpit area, the settings of controls, instruments, and fuel and oil control systems were determined. Other components such as the fuel system, landing gear and engine control systems were damaged beyond recovery of status but had been set to the correct position at the time of the accident, as evidenced by the position of the fuel and oil control systems.

The investigation of the accident was conducted by the flight instructor of the aircraft and subsequently it was not flown for approximately 40 days, from 1976 to 1976, by Pilot Walker with

and engine section. A considerable portion of the engine control system was destroyed, including the fuel and oil control systems. Because of the almost complete destruction of the cockpit area, the settings of controls, instruments, and fuel and oil control systems were determined. Other components such as the fuel system, landing gear and engine control systems were damaged beyond recovery of status but had been set to the correct position at the time of the accident, as evidenced by the position of the fuel and oil control systems.

The position of the remaining wreckage indicated that all three landing gear were extended. Power flap were fully retracted. The flap were fully retracted, the position of the flap of the aircraft, as evidenced by the position of the flap of the aircraft, as evidenced by the position of the flap of the aircraft.

### FIRE DESTRUCTION

Both engines were severely damaged by impact and subsequently destroyed by the fire impact. Although the power systems of both engines were burned down, in general the extension of the engines did not extend any extension of engine failure. Now, however, from No. 1 engine and five from No. 2 engine, was consumed by fire but all the remaining portion of both engines had to extend any extension of engine failure. Extension of the engine failure of both engines was destroyed. Examination of the wreckage indicated that all engines were destroyed. The wreckage of both engines was destroyed. Examination of the wreckage indicated that all engines were destroyed. The wreckage of both engines was destroyed.

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Flanagan, who had recently been promoted from copilot position to pilot. Pilot Hensley was the wing leader and was on the PV-1 while it was on the ground, but among himself with the cockpit and engine most exposed that area in an aircraft on the left side, his first side as a PV-1 type airplane. No discussion or "spiral" was heard on after the PV-1 crash. Next to the Top Flight Check Sheet, which was the only document used in the crew during the entire time on board on the ground before the last flight and the last flight on N 2080C.

### LAST CONTACT

The flight for called MacArthur Tower and asked permission to make a hot run on runway 24, which was granted. Then take off instructions for a hot VFR flight were requested and the tower cleared N 2080C to runway 11 where a visual climb-out was made. This was the last contact the tower had with the flight. All radio communications between the tower and the aircraft were severed. A possible suggestion of radio malfunctions and equipment in hand the PV-1 had been completed successfully the previous day.

The gross weight of the PV-1 at 10:01 at 10:01 was 15,270 lb, which was 4,241 lb under the maximum allowable gross weight, and the center of gravity was located within prescribed limits. The fuel on board was estimated at 1,320 gal.

At 10:01 three minutes before the accident occurred the W & W. Warner Bureau recorded a ground observation from MacArthur Field as calling estimated 4,000 before 5:00 around 10:01. It was, however, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 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G. D. Schott (center), Flight Controls Department head, discusses a rocket control system with Group Engineer R. A. Fay (right) and P. G. Hudson, missile components research specialist.

The transition from theory to reliable computers is one of the most difficult phases of flight controls endeavor. At Lockheed Missile Systems Division, engineers and scientists are performing advanced work on a number of theoretical approaches that offer important practical solutions.

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- Systems verification by using computer simulation

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#### SAFETY

altitude was at 1,500 ft., or higher, at the time of separating war altimeter design testing performance of the TV-1, such as slow flight.

It is evident that the accident did descend from a higher altitude and there was observed to enter a spiral or stall at a spin from a stall.

TV-1 recovery from this condition was not accomplished before ground contact.

The investigation covered all control factors to the extent that the design provided for design provided. The possibility of control control by the incorporation of the test, and reached agreement by design aspects was investigated but with negative results. Impact and fire damage could have destroyed evidence of control mechanisms.

Design by ground contact and fire provided an accurate determination of engine operation.

The examination of the papers indicated that they had been capable of developing control power prior to the accident. Had power instrumentation occurred without loss of control, the open area below was available for emergency landing.

Normal and safe procedures had been followed before the accident flight as shown by the 40-man test flight in which Pilot Hunsley acted as observer, the test speed by him on the ground in cockpit landings, and the practice itself did make an engine 20 and below the actual altitude.

According to experienced PV-1 pilots, stalls in the type aircraft are "extremely severe" and considerable altitude is lost before recovery. It appears that in the accident the pilot, while practicing forward simulation maneuvers, permitted the aircraft to stall at a low altitude.

#### FINDINGS

Upon consideration of all available evidence, the Board finds that:

1. The TV-1 aircraft was correctly certified.
2. The altitude height of the aircraft was more than 1,500 ft. under the maximum gross weight and the load was properly distributed.
3. Weather was not a major factor.
4. The altitude probably did not exceed 1,500 ft. above the ground during the accident because the aircraft was at the 100 ft. down was on the ground to impact.
5. There was no evidence of failure of the engine or any of the controls as far as it could be determined.
6. There was no evidence of power failure at either engine.
7. The purpose of the flight was pilot certification and included slow flight.
8. The aircraft was observed to stall at the reported approximately 1,500 ft. above the ground.

#### PROBABLE CAUSE

The Board determines that the probable cause of this accident was loss of control resulting in a stall at an altitude too low to allow recovery.

By the Civil Aeronautics Board:

- (S) James F. Mason  
(S) Harold P. Dwyer  
(S) G. James Morrison  
Dallas, Chairman, and George, Member,



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in Greek missile systems, and, with the aircraft, the Greeks developed one of the earliest weapons systems. Referring to the height of its effectiveness during the Middle Ages. Today's weapons systems are increasingly more complex, the systems complex. The Greek advances of science enable only the highly integrated engineering system to keep pace with the changes. Combined with a progressive management policy, such a team is a relatively short time can achieve a goal that once took centuries.

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RE-10

130

## SAFETY

did not take part in the adoption of this report.

The Civil Aeronautics Board was notified of this accident at approximately 1730, Jan. 26, 1976. An investigation was immediately started in accordance with the provisions of Section 701 (a) (2) of the Civil Aeronautics Act of 1954 as amended.

### AIRCRAFT OWNER

The Seattle Aircraft Corp., a subsidiary of Orion Service Co. Inc., has headquarters at 68 West Street, New York, N. Y., and an office at Westchester Plaza, Scarborough, L. I., N. Y. The company owns several transport type aircraft that do not fly to transport company personnel throughout the United States.

### FLIGHT PERSONNEL

Capt. Bernard J. Mulder, age 38, held a commercial pilot's license with ratings of commercial pilot, instrument, and pilot single and multi-engine land, and type ratings on Douglas DC-1 and A13, Lockheed 14, and PV-1. He was employed by the parent company Jan. 23, 1977. Capt. Mulder had approximately 5,000 flight hours, of which 217 hours were as PV-1 aircraft. His last Class I physical examination was passed on Nov. 16, 1975.

First Hage D. Higgins, age 35, held a commercial pilot's license with ratings of commercial pilot, instrument, single and multi-engine land, and instrument. He was employed by the company Aug. 13, 1971.

Pilot Fierstein had approximately 800 pilot hours, of which 600 hours were as PV-1 aircraft. His last Class I physical examination was on Oct. 10, 1974.

Pilot Edmund Blumberg, age 31, held a current pilot's license with ratings of single and multi-engine land, and type ratings on Douglas DC-1 and DC-1A. He was employed as a pilot by the company on Jan. 19, 1976. Pilot Blumberg's last time was approximately 1,000 hours, of which was the subject instrument flight was on Lockheed PV-1 aircraft.

### THE AIRCRAFT

Lockheed PV-1, N 7080C, serial 5241, was manufactured in 1945 for the U. S. Navy. It was produced from the Quaker Run Company on Sept. 18, 1945. The aircraft was built with 2,216.21 lb., with 1,450 lb. more weight added, and 40 man since the last 140 lb. inspection. The aircraft was equipped with two Pratt & Whitney model 5500-B1 engines and two Hamilton Standard model 21E-101 propellers with model H77-143 blades. Time on this aircraft was reduced to 149 hr. and 55 hr. Time on the propellers were reduced to 417 hr.

### Republic Passes Out Christmas Bonus

Fairfield, N. Y.—Republic American Corp. was scheduled to pass out its 1974 annual Christmas bonus for its employees, amounting to \$1,977,000, this week. The bonus is expected to pay each employee's pay for each of the 16,000 pay periods of the company.

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## AMC Contracts

**Wright-Patterson AFB, Ohio/Feb.** Issued a list of unclassified contracts for \$75,000 and over as released by the Air Materiel Command.

**General Electric Co., Erie, Pa.** \$10,000 for facilities for the production of 100 components.

**Boeing Aircraft Co., Chicago, Ill.** \$10,000 for 10,000 of electric engine systems.

**Boeing and Kollsman Corp., Seattle, Wash.** \$10,000 for 10,000 of electric engine systems.

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position of responsibility and challenge in  
the design, development and testing of  
armored, armored and armored vehicles.  
General Design Systems, Inc. is a  
leading firm in the design, development, and  
testing of armored vehicles.5. **ARMED, COMBAT ENGINEER** is a  
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the design, development and testing of  
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leading firm in the design, development, and  
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General Design Systems, Inc. is a  
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testing of armored vehicles.

## DESIGN ENGINEERS

Like the super aircraft it produces today, Chance Vought's design organization is the result of two  
generations of technical refinement. This team has the finesse you'd expect of four decades'  
experience — a knowledge compounded of history-making projects. Yet it hasn't  
outgrown its inquisitive, vigorous approach to new problems. Today these problems represent  
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## LIAISON ENGINEER FOR WEAPONS SYSTEMS TO \$12,000

General Electric's Light Military Electronics Equipment Department is organizing a team of systems evaluation engineers to support a weapons system evaluation program. The team will synthesize weapons systems and evaluate with design teams.

The following areas of knowledge and experience will be important in the evaluation of a prospective employee's capabilities:

#### Engineering or Physics degree.

Advanced degree in mathematics, engineering or physics. Operational experience with weapons systems, aircraft or airborne electronic equipment.

Responsibly participate in activities for planning, development, procurement, test and evaluation of weapon systems equipment.

Experience in planned advanced development study and proposal activities of military airborne and electronic products.

Reply in confidence to Mr. John Steinberg, Dept. 864,  
Light Military Electronics Equipment Dept.,

**GENERAL ELECTRIC**

Franklin, Mass.

Circle 18

The position  
is in El Paso, N. Y.,  
a cosmopolitan city  
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With excellent advancement opportunities in both Technical and Management direction.

Combining studies in the most advanced aircraft structural research and development with supervisory and management responsibilities of an analytical technical study group.

MS or PhD in Aero Engineering and Structural Analysis with approximately 8 years applicable experience preferred. Salary commensurate with qualifications.

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Interested applicants may send resume to:

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translating Federal contracts available with growing aircraft manufacturers to become key industrial staff men with broad experience in:

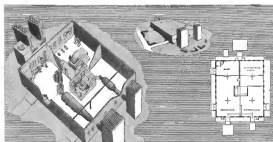
1. Complete Aircraft
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Director of Contracts

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**HELICOPTER PILOTS & MECHANICS  
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chapter on  
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*Transonic and Supersonic flow duct wind tunnel facility for Republic Aviation Corporation*

## a special message to wind tunnel engineers and scientists

### ANNOUNCING UNUSUAL OPPORTUNITIES WITH REPUBLIC'S NEW WIND TUNNELS SECTION OF THE R & D DIVISION

A new wind tunnel installation doesn't open every day!

Yet, that's exactly what's happening at Republic Aviation. A brand new installation is being planned for Farmingdale, Long Island, dedicated to the study of all the complex, aerodynamic aspects of passage through the upper atmosphere.

What are the results to you?

If you're presently a Director or Assistant Director of a wind tunnel installation, it means an opportunity to change pace—to express your ideas—and then implement them on a brand new facility. And at the same time, to broaden your professional horizons.

Or perhaps you're a member of the operating staff at a wind tunnel. You've got experience, ability, confidence. But you'd like a chance to get in on the ground floor of a new operation, with the most modern facilities at your command—and increase your responsibility from the very start.

If you're in any of these categories, you owe it to yourself—and your family—to check the following requirements and then contact us.

**DIRECTOR:** Should have 10 to 15 years' experience in the design, construction and operation of wind tunnels and related facilities, as well as complete staff administration.

**STAFF:** Preference will be given to people with direct or indirect experience, or all levels, in wind tunnel.

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Please send complete resume, in strictest confidence, to:  
Mr. D. G. Stern, Engineering Personnel Manager.



**REPUBLIC AVIATION**

FARMINGDALE, LONG ISLAND, NEW YORK









## LETTERS

### S.58 Selected

I have read with a great deal of interest your series of three articles concerning the procurement and use of American-built helicopters in the French Moroccan area (AVF Sept. 17, p. 25; Sept. 24, p. 35; Oct. 1, p. 78). Since we were following the evaluation test previously performed at Fort Rucker, and since, as we were vitally interested in the results, we were in a favored position to judge the accuracy of the reports. Please accept my compliments on this point.

Based on our knowledge the article was drafted a fine example of accurate and unbiased reporting.

As you probably know, the tests were to determine the structure of which type would be manufactured under license in France and I am pleased to report that is the final analysis the 3-60 was selected for this purpose and so have since concluded a license agreement with Sefin Aviation under sponsorship of the French government for this purpose.

B. L. Wernke  
General Manager, Siskin Aircraft

## Bendix Defense

Reader: Pittsburgh's apparent slowness over the Air Force's "dangling responsibility" (described) for safety and property "incidents" described, etc., of the 1956 Reader Trophy Race (AIF Nov. 16, p. 312 Letters) should not go unnoticed.

He moved that Spring a high performance aircraft cross-country and landing with virtually no fuel only efforts to structure flight planning, precise knowledge of the aircraft's performance and engine fuel consumption. To summarize, it is possible to structure the same knowledge that would, if used by, enable a pilot to deliver a drop load against an enemy and return safely home.

It is commonly agreed that this sort of thing has no place in sport aviation. You can be sure that flying safely, which is common to both the adherents of one million-dollar warplanes and the people who fly and are flown in them, is of vital interest to the military. The Bendix Trophy Race is an opportunity for civilians like us, Mr. Folsberg, to see that the commonness is being realized from an expensive aircraft landing with a large fuel source as a Bendix Trophy Race would not prove much more than planning.

THEODORE R. SOMMER  
Denton, Ohio

### NACA's Problems

As a long-time NACA employee (until last September), I was very pleased with your editorial in the Nov. 5 issue. Unfortunately, you did not strike at the serious problem which is destroying the audience of all that we represent. Lack of news

**Delaney Week** celebrates the spirit of its readers as the issues return to the magazine's editorial calendar. Address letters to the Editor, *Delaney Week*, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 300 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

and particularly skilled ones, to operate the loom, such as the darts, and put it in usable repair form. The Langley Labours had lost about 170 during 1936 at the time I left, and this has been going on for several years.

I doubt if a dozen new engineers were hired during 1934, or in any year since about 1932.

(One exception is 1974, 13 agreements on duty with the Air Force were stippled in AFR.)

What's the trouble? Just a simple matter of money. After the war the NAGS had no systematic flow run through the civil service grades to keep pace with salaries at schools. In the last two or three years the inevitable happened, and all their best men began running into the top of the civil service grades GS-15. A few super grades, GS-16, GS-17, GS-18, GS-19, GS-20, GS-21, GS-22, GS-23, GS-24, GS-25, GS-26, GS-27, GS-28, GS-29, GS-30, GS-31, GS-32, GS-33, GS-34, GS-35, GS-36, GS-37, GS-38, GS-39, GS-40, GS-41, GS-42, GS-43, GS-44, GS-45, GS-46, GS-47, GS-48, GS-49, GS-50, GS-51, GS-52, GS-53, GS-54, GS-55, GS-56, GS-57, GS-58, GS-59, GS-60, GS-61, GS-62, GS-63, GS-64, GS-65, GS-66, GS-67, GS-68, GS-69, GS-70, GS-71, GS-72, GS-73, GS-74, GS-75, GS-76, GS-77, GS-78, GS-79, GS-80, GS-81, GS-82, GS-83, GS-84, GS-85, GS-86, GS-87, GS-88, GS-89, GS-90, GS-91, GS-92, GS-93, GS-94, GS-95, GS-96, GS-97, GS-98, GS-99, GS-100, GS-101, GS-102, GS-103, GS-104, GS-105, GS-106, GS-107, GS-108, GS-109, GS-110, GS-111, GS-112, GS-113, GS-114, GS-115, GS-116, GS-117, GS-118, GS-119, GS-120, GS-121, GS-122, GS-123, GS-124, GS-125, GS-126, GS-127, GS-128, GS-129, GS-130, GS-131, GS-132, GS-133, GS-134, GS-135, GS-136, GS-137, GS-138, GS-139, GS-140, GS-141, GS-142, GS-143, GS-144, GS-145, GS-146, GS-147, GS-148, 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The month has dropped noticeably in the last two years.

I have a number of regrets concerning my decision [possibly influenced by a \$10,000 income in salary over NISCA, however]. The working conditions were fine, the facilities of athletes almost idealized (except by the amount of expatriated income assistance available), the test facilities and supporting services the best in the country and probably in the world around the time they were stated in your edition.

Those who have left the NACA to wife (and I set within a strong) share of a down or more) are still local and are strongly concerned that the quality and, perhaps less, but still important, the quantity of NACA output will continue to decline.

Averett Ward's articles on the 1935 suspension have not stood these harsh facts. Somehow they must be brought home to Congress.

I truly believe that this is a critical work item to our country's technological progress. Please ensure, in your review, the concerns of this problem which must be vital. The suggestions left in your articles and editorial is that all's well with the NACA. Please tell my thank if you think this is

For more help call your otherwise and  
welcome your support.  
FORREST NACA Executive  
Cincinnati, Ohio

## Electoral Safety

[illegible]

I have gone to considerably lengths due to the fact I want to construct the di-

over the past 25 years in accordance with development of the radiotube principle, even to the extent of leaving Reaction Motors and focusing the Philco-Ken Corporation with the development of aircraft safety equipment as one of its principal operations. For your article calling attention to the radiotube, therefore, I am grateful. There are two points in your article, however, which should be clarified as justice to our company and to the people who are going to use radiotube cathodes.

I particularly want to make clear that the schematic shown on the lead page and captioned, "Fukushima's epicenter" is, in fact, an early Russian Vostok satellite image of the epicenter. Fukushima has it on-line with the claim that this particular version could

That is the question of overall misshaping. You stated that the "imposed view" was "unfairly in one hand, or grossly conscious only by virtue of the very very slow and dourly. The statement is a

tively represented as regards the reliability and value, whatever is the industrial principle. The truth is that the socket-type coupling can be made safer and more reliable than existing couplings, in spite of the greater weight of propellant used. The company is presently developing such a unit.

Midwest Bank is a disingenuous lawsuit, even as your bank, and there will inevitably be countless resulting from system failures and human error. It is that company's re-

service, though as we are sure it is the intention of our competitors, that certainly do not result from failure of the "last word" device meant to prevent them. Neither capsule nor socket tubes in any present form are the last word in sperm equipment. You will be doing a real service if you continue to furnish wanted new devices.

Devon Fulton  
The Fulton Group Corp.  
Barnstable, N. J.

for SAC's new B-52 Stratofortress...



### **Flight Control System—by Sperry**



H. C. BOLTUNOV Manager of our beautiful Eco-park! Healthy and hearty pine-squirrels, feeding playing - his experience in pine all places, forests and meadows.

of many Sperry automatic light control systems in the car lobby. Other Sperry systems are in use on many of the world's leading airlines, on hundreds of business planes and thousands of military aircraft. Tomorrow, new Sperry systems will be flying many of the world's joint turbo-prop transports now under development.

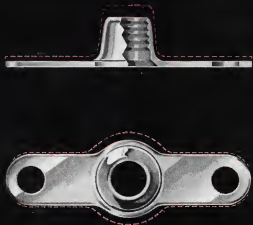
If you have a problem in automatic flight control, Sperry engineers can help you find the right answer. Write our Aeronautical Equipment Division.

**SPERRY** *ENGINEERING COMPANY*  
Over 100 Years of Service

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【参考文献】：1. 中国疾病预防控制中心. 中国预防医学杂志. 2004; 25(1): 1-4.  
2. 中国疾病预防控制中心. 中国预防医学杂志. 2005; 26(1): 1-4.

- Lower height . . . (.205" vs. .254")
- Narrower width . . . (.328" vs. .400")
- Lighter weight . . . (.25#/C vs. .35#/C)
- Counterbored . . . (.060")



## New Low-Height Counterbored Locknuts Conform with NAS Drawings

The new ESNA LHTA51 series of self-locking nuts was designed to meet the requirements of the recently released NAS679-695 drawings for low-height counterbored nuts. Intended for structural use, and developing the full tensile strength required by Spec MIL-N-25027 (ASG), they perform satisfactorily at temperatures up to 550°F. These parts have also been approved to AN-N-10 and drawings AN362 and AN366.

The LHTA51 series offers several special advantages to the designer:

**Minimum envelope dimensions and weight** compatible with performance to the tensile, vibration, twist-out and push-out requirements of MIL-N-25027 (ASG).

**Reduced height** permitting use of 160,000 psi heat treat short length NAS bolts to still further cut down weight of nut and bolt assembly.

**Counterbore** in the base of the nut assures that bolt threads will not be in bearing. This eliminates the weight of an extra shim in many applications.

**Repeated use and reuse** without loss of efficiency.

### CHOOSE THE SOLUTION TO YOUR FASTENING PROBLEM FROM A COMPLETE LINE OF NUT SHAPES!



One lug Floater  
(#8 through 5/16")



Two lug "Fixed" anchor  
(#8 through 5/16")



Two lug "Floater"  
(#8 through 5/16")



Gang Channel  
(#8 through 5/16")

(and others not illustrated here)

**ELASTIC STOP NUT  
CORPORATION  
OF AMERICA**



### MAIL COUPON FOR DESIGN INFORMATION

Dept. N18-1225, Elastic Stop Nut Corporation of America  
2330 Vauxhall Road, Union, New Jersey

Please send me the following free fastening information:

- ☐ Spec Sheets on New LHTA51 Series ☐ Here is a drawing of our product. What type of self-locking fastener would you suggest?

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_